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THE

JOURNAL OF SCIENCE.

AUGUST, 1885.

I. A CHARACTERISATION OF MR. DARWIN'S MASTERPIECE.*

By OSWALD DAWSON.

A marble statue of Charles Darwin was unveiled yesterday morning at the Natural History Museum in Cromwell Road, South Kensington, and was received in trust for the nation by the Prince of Wales, as representing the trustees of the British Museum. The statue is placed on the landing of the principal staircase leading from the great hall. . . . The committee also proposed that a medallion should be placed in Westminster Abbey.—*Morning Post.*

We are all agreed to regard [natural selection] as at least an important factor in the origin of species.—ST. GEORGE MIVART.

I call upon the doughtiest here to bear
This witness unto Truth,—that though he go
Goliath-armed against her, he shall lie
Felled by a stripling shepherd in a smock
Who fights for her.—*Diabolus Amans.*

THE speech of Professor Huxley when unveiling the Darwin statue, on June 9th, contained a recognition of the fact that, although "the phase of vehement "opposition" had passed, yet honourable antagonists (and

* It may be well to give one or two facts showing that the *Origin of Species* is regarded as Mr. Darwin's masterpiece. This work, which has just reached its twenty-eighth thousand, is the only one mentioned in Professor Huxley's *Nature* Memorial Notice, or in his speech at the unveiling of the Darwin statue.

The following relevant quotation from the 'Half-Holiday Handbook' *Round Bromley and Keston* will interest intending pilgrims:—"Though his

by implication dishonourable ones) were still to be numbered. The clause running "Whatever may be the verdict "of posterity upon this or that opinion which Mr. Darwin "has propounded" indicates that, whatever the boast of Evolution, Mr. Darwin's opinions are not for all time victorious all along the line. All these announcements are admirably true. Assuredly *vehement* opposition has subsided since lithesome theology saw its way to countenance Darwinism without renouncing orthodoxy. Assuredly Mr. Darwin's assailants are no defunct race; and as assuredly there are anti-Darwinians and anti-Darwinians. And most assuredly, too, is Darwinism still *sub judice*.

The following article aims to be a portrait of the literary, scientific, philosophical, and moral characteristics of Mr. Darwin's masterpiece; and as the features in a photograph are unaffected by the integrity of the operator at the camera, so my task is, as it were, passive. I wish to obtrude no personal observations other than that the previous sentence must not be construed into a concession that prejudice has influenced the composition of this article; inasmuch as the only emotion which has exercised me in this connection has been one of some satisfaction on finding that the literary, scientific, and philosophical merits of Mr. Darwin's masterpiece are not of such a magnitude as to neutralise the moral obliquity displayed therein. The resemblance to a photograph is, however, incomplete, for the many laudable features of Mr. Darwin's works and character are not detailed here, while at the same time the article does not profess to be an exhaustive catalogue of the defects. No space will be devoted to repetition of these prefatory remarks (nor to any concluding ones). Regard for them is therefore now, for fairness' sake, solicited.

Literary Characteristics.

The term literary is here used in a wide sense; my task not being to collect the passages of "unstudied eloquence

"body lies in Westminster Abbey, his best monument will be that 'Origin of "Species' which, it has been declared, marks a new epoch in the history of "scientific thought. His late residence is called Downe House, and is situated "on the south of the village in Luxted Lane. The road on the north side of "the church leads to High Elms, the country seat of Sir John Lubbock, "Bart., M.P.," &c.

The term here, however, must on many occasions when used be understood to include also the *Variation under Domestication*, and the volumes which were to follow. Of course under *Variation under Nature* is included variation under nature, the struggle for existence, and natural selection.

"which here and there breaks out in the *Origin of Species*," in alleged contrast to the flatness of Mr. Herbert Spencer's writings, but rather to enquire—Is the work a finished edifice and a coherent whole? Do we frequently encounter dogmatism, *petitio principii*, &c.? Are courtesy to opponents and loyal recognition of predecessors everywhere conspicuous?

The *Origin of Species* is not a finished edifice. It is an "abstract." Nine years after its publication the first instalment of the work proper appeared, and the succeeding fourteen years of Mr. Darwin's life did not witness the transition of either of the two remaining instalments from a manuscript to a published existence. The work was, notwithstanding, "nearly finished" in 1859 (p. 1).* "The "cause [thereof] is well-known to have been the continued "pressure of ill-health," writes one. "Perhaps the greater "interest of new experimental work" supplemented the cause of ill-health, says another; while a third relates that "so successful was the work that Mr. Darwin did not find it "necessary to publish all the volumes of accumulated facts "which he had intended to supply by way of evidence." But inasmuch as two editions of the *Descent of Man*, "the publication of which" Mr. Wallace tells us "was not "anticipated by its author three years before," betoken no intellectual collapse; and inasmuch as the *Descent of Man* is not experimental work, one prefers to reject the former solution; especially when we learn that Mr. Darwin told Prof. John Fiske that "it seemed no longer so necessary as "it had once seemed" to publish the remaining volumes.

Now while "no one," says Mr. Darwin, "can feel more "sensible than I do of the necessity of hereafter publishing "detail all the facts, with references, on which my conclu- "sions have been grounded" (p. 2), some may suspect that the interests of many of those conclusions were not prejudicially affected by the abandonment of the enterprise; for concerning the *Variation under Domestication* reasons will be given in the following section for endorsing the opinion of Dr. Mivart that it is "somewhat problematical how far" this work is calculated to favour Mr. Darwin's doctrines, while concerning the *Variation under Nature* considerations will be mentioned rendering it probable that, in some

* The title, *Origin of Species*, will be omitted throughout. The edition quoted from is the sixth, with additions and corrections to 1872, in every instance when not otherwise specified. Pages preceded by the numerals i. or ii. refer to the first or second volume of the *Variation of Animals and Plants under Domestication*, second edition, revised, 1875.

respects, "Mr. Darwin gains rather than loses by the neces-"sity which he so often deplores, of having to curtail his "evidence," to adopt the phraseology appled by the *London Reviewer* of the *Or. of Sp.* to this last-named work; while concerning the evidence corroborative of Evolution (the subject-matter of the final instalment, or chiefly so) a cynic might say that so successful was the *Or. of Sp.* in assimilating the doctrine of "descent with modification" with that of "descent with modification through variation "and natural selection," that Mr. Darwin did not think it necessary to publish further evidence of their identity in his own mind,—a remark well adapted to serve as a transition to the discussion of the second heading.

The *Or. of Sp.* is "one long argument" (p. 404), with "two distinct objects in view; firstly, to show that species "had not been separately created, and secondly, that na-"tural selection had been the chief agent of change" (*Descent of Man*, p. 61).

The consequence of this procedure has been now a confusion, now an identification of the theory of Evolution and the theory of Natural Selection throughout the *Or. of Sp.*; with the result of floating the proposition that the issue is 'creation *versus* natural selection,' rather than 'creation *versus* evolution.' Mr. Samuel Butler remarks:—"To do this prevents the reader from bearing in mind that "the 'evolution by means of the circumstance-suiting "'power of plants and animals,' as advanced by the earlier "evolutionists, and 'evolution by means of lucky accidents,' "[may] the one be true and the other untrue. . . . Hence "[also] when he falls in with such writers as Professor "Mivart and the Rev. J. J. Murphy . . . he imagines that "evolution has much less to say for itself than it really has." To give details. In explaining similarity of pattern among diverse orders, choice is offered between creation and "the theory of the selection of successive slight modifica-"tions" (p. 383), and again in accounting for serial homologies (p. 384), in connection with palæontology (pp. 290, 313, 407), in connection with distribution (p. 362); while on the other hand "the two theories of independent creation and "descent with modification" are mentioned in connection with the last-named topic on p. 347; while there is a like absence of qualification in the treatment of classification on pp. 365 and 369, and of rudimentary organs on pp. 400 and 402, and both combined on p. 373. The same end was at other times gained by a substitution of one theory for the other in the course of a single argument. Thus the title of

Chapter VI. is "Difficulties of the Theory," no attempt to advance the general doctrine of descent with modification having been made in the previous chapters, which treat of selection, &c. The contents, however, commence with "Difficulties of the Theory of Descent with Modification."—but before the reader turns the page he is asked "Can we "believe that *natural selection** could produce" a giraffe's tail and an eye? "Can instincts be acquired and modified "through natural selection?" Mr. Samuel Butler, citing analogous instances from pp. 406, 416, and 419, remarks:—"This is calculated to mislead." Or, again, where descent was once the term, natural selection is substituted in a later edition (ed. 1, p. 188; ed. 6, p. 145). In corresponding fashion the appellations "my," "our," and "the" theory are indiscriminately employed. "My view" pitted against "the ordinary view of creation" on p. 351, in connection with distribution, may refer to descent with modification simply, while in the summary on *natural selection* it is stated that "on my theory unity of type is explained by unity of "*descent*" (p. 166). It is similarly used in connection with hybridism on p. 236; and in like manner "our theory" is spoken of in connection with distribution at p. 359, here referring to evolution, whereas the same expression on p. 375 presumably refers to natural selection, and yet again to evolution on p. 379. Lastly, the "view here maintained," on pp. 354 and 389, refers to evolution, distribution and morphology being here under discussion, though the phrase "through variation and natural selection" is appended on pp. 290 and 313, palæontology being here the subject-matter of debate. Now (limiting our questioning to the last sentence), are we to infer that Mr. Darwin found support for natural selection in palæontology rather than in distribution and morphology?

Mr. Darwin feared that "it will indeed be thought that "[he had] an overweening confidence" in his theory, and he it was who remarked "Great is the power of steady mis-"representation" (pp. 231, 421). Well, overweening or no, his confidence was such as to permit a very steady representation of the view that "through variation and natural "selection" was an indispensable appendage to the phrase "descent with modification," and this notwithstanding a recognition of a modern school of saltatory evolutionists, and the circumstance that the Historical Sketch mentions yet other agencies than saltation and selection as advocated

* The italics are mine throughout unless otherwise stated.

by a "justly-celebrated naturalist" and by "our great phi-"losopher (pp. xiii., xix., and *Descent of Man*, p. 123). And when confidence takes this shape it becomes the parent of dogmatism. And a work thus characterised in its *ensemble* will rouse suspicion concerning its *modus operandi* in particular instances. And we *do* find in the *Or. of Sp.* those literary misdemeanours which Dr. Mivart insists are so conspicuous in the *Descent of Man*, namely, dogmatism and *petitio principii*.

The reader should ever be on the alert to distinguish between Mr. Darwin's statements in natural history and his expression of opinion. To cite an interesting fact:—For some reason Mr. Darwin substituted the statement that "*there is no difficulty in supposing*" that missing links "formerly existed," "and that each was developed [owing "to its] having been useful to its possessor" (p. 139, also ed. 5), for "*I see no difficulty in supposing*" that missing links "formerly existed," "and that each grade of structure was "useful to its possessor" (ed. 4, p. 208). Mr. Darwin affirms that "as modern geology has almost banished such "views as the excavation of a great valley by a single dilu-"vial wave, so will natural selection banish the belief of the "continued creation of new organised beings, or of any "great and sudden modification in their structure" (pp. 75, 76); the proviso "if it be a true principle," inserted before the word "banish" in the first edition, being here withdrawn.

In arguing against creation (p. 365) Mr. Darwin styles "the *vera causa* of community of descent" (p. 125) "the "only known cause of close similarity in organic beings." Possibly he is here referring to the close similarity of the sexes, for he does "look at all the species of the same genus "as having as certainly descended from a common proge-"nitor as have the two sexes of any one species" (p. 124), in the course of the argument implying that the special creation school holds such hypothesis concerning the differentiation of the sexes. Circumstances will permit me here to simply remind the reader that a not insignificant section of that school teach that "male and female created he them" (Adam and Eve), and that not only were they bidden to "be fruitful and multiply," but that great whales and winged fowl were saluted with the same mandate. Doubtless Moses thought it as little incumbent upon him to catalogue the secondary sexual characters of *Homo*, or other animals, as to enumerate the names applied by Adam to the several creatures brought unto him on that unique occasion.

The statement that "the whole economy of Nature, with "every fact on distribution . . . and variation, will be dimly "seen or quite misunderstood" unless "the truth of the "universal struggle for life . . . be thoroughly engrained in the mind" (p. 49) sounds like a presupposing of the truth of some such solution as the very one on the point of being contended for.

A volume so indefinite as to general aim invites enquiry concerning the amount of harmony manifest in the marshalling of the arguments. And the answer is that many of Mr. Darwin's propositions are so vitiated by incoherence as to render his real teaching inaccessible. To give some instances:—According to Mr. Darwin himself, "in former "editions" he *spoke* as if the preservation of "any single "strongly-marked variation" "had frequently occurred," though he *saw* that such would be "a rare event" (p. 71). We learn that "in a state of Nature . . . animals and "plants . . . have to struggle for existence from the hour "of their birth to that of their death" (ii., 219), yet "when we reflect on the struggle we may console ourselves "with the full belief that the war of Nature is not incessant" (p. 61). Again, not only is the insensibly slow rate of organic change repeatedly insisted upon, but modification under Nature is contrasted constantly with modification under domestication, the latter, though very slow, being the faster of the two; while, further, we learn that 140 millions of years can hardly be considered sufficient for pre-Cambrian evolution, and that 60 million years appears a very short time for that occurring in post-Cambrian times (p. 206); also that, "with respect to the lapse of time not having "been sufficient for the assumed amount of organic change, ". . . this objection, as urged by Sir William Thomson, is "probably one of the gravest as yet advanced" (p. 409); and all this notwithstanding that "we are also *quite ignorant* "at how rapid a rate organisms, whether high or low in the "scale, may be modified under favourable conditions" (*Descent of Man*, p. 156).

Courtesy to opponents and loyal recognition of predecessors are the remaining topics promised discussion under the present head. One instance of each shall occupy us.

Mr. Darwin introduces Dr. Mivart to his readers as "a distinguished zoologist" who "has recently collected "all the objections . . . against the theory," and "illus-"trated them with admirable art and force" (p. 176), thereby convincing Mr. Darwin of, *inter alia*, "much partial "error" (p. 177). He recapitulates the illustrations dis-

cussed, and mentions Dr. Mivart's saltatory hypothesis, adding "some naturalists agree with him" (p. 201). He also admits that, by the discussion, "a good opportunity "has been afforded for enlarging" on a subject not heretofore "treated at sufficient length" (p. 198). Whether, then, his remark that he had "considered *enough, perhaps more* "*than enough*, of the cases, selected with care by a skilful "naturalist" (p. 198), was a conclusion characterised by courtesy the reader will please judge.

Mr. Darwin frequently couples Mr. Wallace's name with his own, and styles the latter's 'contribution' of 1858 "an excellent memoir" (p. 1), in which "the theory of "natural selection is promulgated with admirable force and "clearness" (p. xxi.). But what of the earlier 'contribution' of 1855? Is it not strange that this is ignored in an historical sketch where room was found to announce that Rafinesque thought "that all species *might have been* varieties "once," "*except* the original types"; that d'Halloy deemed creation *less probable* than evolution; or even that Professor Huxley considered evolution "unproven"—not to mention Dr. Freke? Did Mr. Darwin know of this Sarawak essay? Yes; for in the first edition of the *Or. of Sp.* he quoted therefrom Mr. Wallace's law that "Every species has come "into existence, coincident both in space and time, with a "pre-existing closely allied species," adding—"And I now "know, from correspondence, that this coincidence he attri-"butes to generation with modification" (p. 355), just as though the Ternate essay had never been written!

The above law was conceived by Mr. Wallace as early as 1845, and since then he had taken "every opportunity of "testing it by all the newly-ascertained facts with which he "had become acquainted or had been able to observe himself," for he deemed the advent to new species to be "the most "difficult and at the same time the most interesting problem "in the natural history of the Earth." He attributed the characters of the plants and animals of the Galapagos to their having been "first peopled, like other newly-formed "islands, by the action of winds and currents, at a period sufficiently remote to have had the original species die out, and the modified prototypes only remain." He considered that "the risings and fallings in the scale of organisation "[can alone] be in every case explained" by supposing that "lower forms which have better resisted the modified phy-"sical conditions have served as the antitypes on which to "found the new races." He speaks of "modifications of "structure and organisation" being "given" to groups.

In his Preface this most modest writer refers to the Ternate *and Sarawak* contributions as having won him honour as an independent originator.

The immediate causes of the publication of the *Or. of Sp.* in 1859 are well known.

Scientific Characteristics.

Of more moment than any question hitherto treated is the ensuing enquiry:—Does Mr. Darwin's masterpiece favour Darwinism? It may be asked how, if that work really shows the literary blemishes depicted above, can one hope to ascertain the meaning of Darwinism? The question is a formidable one, but I must mention that in the December (1884) issue of this Journal I ventured to offer "a "definition of Darwinism, sufficiently succinct for mnemo- "nical purposes, and amply substantiated by copious "quotations." For the benefit of such as did not avail themselves of the hint to commit it to memory, and also for the use of those who were not subscribers prior to 1885, I must copy it here:—

> From one to at most ten pre-Cambrian, presumably unicellular organisms, created, and vivified by the Creator's breath, have arisen, without any subsequent interference, and we can hardly believe otherwise than without beneficent guidance, the structures and the bodily and mental activities of all organisms, by the accumulation, mainly by Natural Selection, of variations so minute as to be appreciable only to well-trained eyes, occurring in correlation but not in co-ordination with related variations, affecting single individuals, inducing intermittent modification, and being determined in their nature by an innate idiosyncratic plasticity, the chief ultimate cause of which is probably the accumulating action of changing conditions upon the parents, but more especially remoter ancestors, of the varying individual.

It has been alleged by several writers that Mr. Darwin repudiated Darwinism, or even natural selection. Though very erroneous this statement has a substratum of foundation, as I shall show at some length.

Idiosyncratic plasticity is the starting-point of Darwinism.

> Mr. Darwin perceived the liability of the obliteration of these variations [resulting from idiosyncratic plasticity]. In former editions he "spoke" as if the preservation "of any single strongly-marked variation" "had fre- "quently occurred," though he "saw" that such preservation would be "a "rare event" (p. 71). Nevertheless, until reading an able and valuable article "in the 'North British Review' (1867), [he] did not appreciate *how rarely* "single variations *whether slight or* strongly marked, could be perpetuated" (*Ibid.*). . . .
>
> "To the effects of intercrossing in eliminating variations of all kinds I "shall have to recur [the subject having already been once postponed (p. 34);]

"but it may be here remarked that most animals and plants keep to their "proper homes, and do not needlessly *wander about*; we see this even with "migratory *birds*, which almost always return to the same spot" (p. 72). He subsequently recurs as promised—to remark that "Intercrossing will "chiefly affect those animals which unite for each birth and *wander much*; "for instance, *birds*" (p. 80). . . .

Having admitted that free intercrossing will "check, by blending together, "any slight deviation" (p. 11), in summing up he finds that "the result will "often be greatly retarded by free intercrossing" (p. 84). In the *Var. under Dom.* he considers the effects "so obvious that they need not be discussed at "much length" (ii., 62) for "with respect to the very slight differences by "which individuals of the same sub-variety, or even of allied varieties, are "characterised, it is obvious that free intercrossing would soon obliterate such "small distinctions" (ii., 67) . . .

It better ensures the propagation of a new character if both parents are similarly characterised (i., 460). "In the great majority of cases a new cha-"racter . . . is not strongly inherited"; judicious watching is necessary (ii., 177). "In a *few rare* cases peculiarities fail to be inherited, apparently "from the force of inheritance being too strong" (i., 465; ii., 58), but "when "any deviation in structure or constitution is common to both parents, this is "often transmitted in an augmented degree to the offspring" (p. 237).

Let it be "remembered that selection may be applied to the family" (p. 230).

The topic last mentioned occupies thirty lines of the *Or. of Sp.*, and is applied solely to the elucidation of the inheritance of instincts by neuter insects. It is pronounced an "explanation" in contradistinction to an "exposition":—

> The root of the question really consists in whether or not it is possible to suppose that natural selection may operate on specific types as distinguished from individual members of species. During his lifetime I had the advantage of discussing this question with Mr. Darwin, and I ascertained from him that it had greatly occupied his thoughts while writing the *Origin of Species*, but that finding it to be a question of so much intricacy he deemed it unadvisable to enter upon its exposition—*Mental Evolution in Animals*, by GEORGE JOHN ROMANES, M.A., LL.D., F.R.S. London, 1883 (p. 298).

The Inheritance of Instincts by Neuter Insects.—This difficulty is fully discussed by Mr. Darwin in the *Origin of Species*, but his explanation of it is, as usual, ignored by Mr. Mivart. [The passage on p. 230 is then cited.]—"Professor Mivart on Instinct," by GEORGE J. ROMANES, in the *Fortnightly Review* for July, 1885.

Recent politics (*re* the *arrangement*, not *agreement*, with Russia) are here recalled. It is all very well to talk about the "preservation of favoured RACES in the struggle for "life," as it may be sensible to bid housewives "Take care "of the pence, and the *pounds* will take care of themselves;" but when there is no prospect of either the races or the pounds ever arriving, it is a tantalising sub-title or motto to the biologist or housewife, as the case may be.

The evidence for Darwinism to be found in the *Or. of Sp.* fluctuates about zero. Of convergence of probabilities, re-

cently insisted upon by Dr. W. B. Carpenter, there is barely a semblance.

It is no reproach to the *Var. under Dom.* that it does not demonstrate Mr. Darwin's doctrines; no more than if a structure consisting of spokes without fellies fails to act as a wheel. The question is, rather, Does it favour them? The answer is, By no means, unreservedly. First, as to inheritance. Many facts related to show its force very doubtfully favour the view that idiosyncratic plasticity gives promise of exerting sufficient power for Darwinian purposes. Numerous instances "showing how feeble, capricious, or "deficient the power of inheritance sometimes is" are given, and "numerous analogous facts could be given" (i., 461). "Many analogous facts could be given" (i. 464), &c., though many such are explicable (i., 470-72).

It must be mentioned that Mr. Darwin concludes his summary (ii., 61) by expressing full confidence in the success of the enterprise, thus:—"In these laws of Inherit-"ance we see an ample provision for the production, "through variability and natural selection, of new specific "forms."

Next, as to variation. The copious nature of unutilised data is again conspicuous, here in the treatment of factors ancillary to the prime Darwinian one, namely, the indirect and indefinite action of changing conditions. We not only get evidence "showing that *extremely slight* differences, "within the same country, or during different seasons, "certainly produce an appreciable effect, at least on varie-"ties in an unstable condition" (ii., 262); are told that "all horticulturists are unanimous that certain varieties are "affected by very slight differences in the nature of the "artificial compost in which they are grown, and by the "natural soil of the district, as well as by the season" (*ibid.*), but learn that "many similar facts could be given" (p. 264), and that "the present chapters were written before I had "read Mr. Herbert Spencer's work, so that I have not been "able to make so much use of it as I should otherwise pro-"bably have done" (ii., 270).

Further, Mr. Darwin is proud of his treatment of use and disuse (p. 176), occupying eight pages, a third thereof being printed in small type, while the section on changed and inherited habits of life announces that "endless similar "facts could be given in the animal and vegetable king-"doms" (ii., 29). The summary notices that "corporeal, "periodical, and mental habits, *though the latter have been* "*almost passed over in this work,* become changed under

"domestication, and the changes are often inherited. Such "changed habits in an organic being, especially when living "a free life, would often lead to the augmented or dimi- "nished use of various organs, and consequently to their "modification" (ii., 346).

Lastly, elsewhere, Mr. Darwin allows that he formerly underrated the results of spontanous variation independent of natural selection (*Descent of Man*, p. 61). Some deem this a concession of great consequence. For their misjudgment, if such it be, excuses might be made. Were that not so, I fail to see anything unjust and unbecoming (to use Prof. Huxley's own words) in enumerating those points upon which Mr. Darwin has modified his opinions.

We now pass to the *Variation under Nature*. "To treat "this subject properly," writes Mr. Darwin, "a long cata- "logue of dry facts ought to be given; but these I shall "reserve for a future work" (p. 33). As is well known, the world is more familiar with these favourite expressions about factual catalogues and future works than with the things themselves. In the *Var. under Dom.*, upon several occasions, Mr. Darwin arrested himself when approaching the topic of variation under Nature, remarking that it would be travelling beyond his proper limit to discuss it there, or to like effect. In short, every means calculated to kindle curiosity is added to the intrinsic interest of an instalment which a logician might possibly have made the "*caput magnum*" of his *opus magnum*.

It behoves me to specify the reasons for believing that the *Variation under Nature*, had it ever emerged from manuscript, would have justified some measure of unfavourable characterisation.

In the first place, the procedure of the *Or. of Sp.* being to show how evolution might be effected, and *afterwards* to show that it had occurred, it is possible that, in the expansion of Chapter II., the word-war about the meaning of species might have suffered amplification. Now the question of the nature of species belongs either to that department of physiology which discusses hybridism (for I presume this is still the criterion), or to that of philosophy which discerns the Creator's motives, or to both; and discussions thereon which consist of tabulations of the arbitrary "opinions of "naturalists having sound judgment and wide experience" (p. 37), but who lack the requisite physiological data or spiritual pretensions, are of a value not at once very obvious as bearing upon Evolution. They may, of course, have other uses.

The second main point discussed in Chapter II. is likewise partially beyond the sphere of natural science. On looking to a suitable quarter we find the following answer is made:—

> There is no reason why there should not be features of similarity between varieties and species. . . . As it pleased Him to stamp the features of one great family on all organic beings by the evident connection that subsists between diverse species and genera, . . . [so] it was to be expected that varieties also would come under the same law of harmony, the same bond of origin and design. . . . Analogies between varieties and species might be, as we say, part of the Creator's harmonious plan, or, as Mr. Darwin says, part of a law of identity between varieties and species: they *might** be either; therefore, to quote them as proof of one side of the question is against every rule of fair evidence.

But I must confess to much hesitation in reckoning this a vulnerable point. However, the quotation may serve to show that there *is* an *altera pars*.

Thirdly, the *Variation under Nature* would probably have been dogmatic. The statement commencing the summary of the chapter on Natural Selection is the *Origin of Species*, and running thus:—"If under changing conditions of life "organic beings present individual differences in almost "every part of their structure, and this *cannot be disputed*," —a statement containing various propositions which Mr. Darwin's opponents *do dispute*, does not promise well. The styling saltatory Evolution a "false belief" (ii., 409) lends support to suspicions.

Fourthly, the fact that Mr. Darwin repeatedly insists that variation under Nature is slower than variation under domestication raises the prospect of a large demand upon the scientific faith.

Fifthly, having found the *momentum* of Darwinism, as it were, on the wane, we could not have looked forward with confidence to its resuscitation in the instalment next following. *Natural Selection* might or might not have been fortified rather than its *rôle* minimised.

An illustration must be given exhibiting Mr. Darwin's incapacity to comprehend rival theories aright. The saltations advocated by Dr. Mivart are by him distinguished from monstrosities. These latter are coupled with "abortive and "feeble attempts at the evolutionary process." By supposing that by monstrosity "is meant some considerable "deviation of structure generally injurious or not useful to

* Italics the *London Reviewer's* (July, 1860).

"the species" (p. 33) Mr. Darwin tacitly concurs. His remark that it is "in opposition to all analogy" to suppose that "many individuals varied simultaneously" (p. 204) shows that he conceived these saltations as analogous to what the vulgar would distinguish as natural variations. And herein a failure to appreciate an opponent's position.

Philosophical Characteristics.

The function of Philosophy is said to be the unification of knowledge; to concern itself with the fusion into more general terms of hitherto unaffiliated truths garnered from the several sciences. These latter strive to assign the phenomena encountered in their domains to what are called "secondary causes," in so doing trusting (some upon one ground, some upon another, and some upon a third) in the Persistence of Force, with its derivative truths, involving, *inter alia*, a belief that "forces, which become manifest, do "so by disappearance of pre-existing equivalent forces." The term may likewise be employed to invest with due dignity the attempt to discern the laws and purposes of interference with the Persistence of Force, assuming such ever occur or have ever occurred. The philosophy of the *Or. of Sp.* is in direct antagonism to the former, and irreconcilable with any form of the latter worthy of being entertained. Let us see why.

Whether Mr. Darwin held that Deity "created a few "original forms," alive *ab initio*, or in the "appearance or "creation" of a "few forms" or of "some one prototype" (either "considerably lower than the lowest mollusc" or only "a little lower than the angels"), with their, or its, subsequent vivification by the breath of the Creator, some force not recognised as persistent in the philosophical sense is summoned. Moreover, the creation of mere *living* beings is almost, if not quite, worthless metaphysically. When a person handles the *plant* called the nettle, quite probably that person alone *feels*,—almost certainly he alone *determines* to avoid contact henceforth. So the theory of Divine *vivification* is not needed to explain sensation or free-will. It has been affirmed that "in the production of consciousness "by physical agents acting on physical structure we come "to an absolute mystery never to be solved"; while Mr. Darwin considers free-will a typically insoluble problem (ii., 428). Deity is a bountiful mine of explanation: surely its services might have been utilised a little here!

To recur to Philosophy. Advocates of Divine interference

regard miracles as factors contributing towards some *dénouement*, or as parts of some plan calculated to gratify Deity directly, or indirectly by elevating his favourite creature. Thus, though (as Cardinal Newman remarks) a sort of atheistic tendency is liable to result from the impressions which a visit to a menagerie gives of the immense variety of animal forms, colours, &c.,—for Nature seems "too strange to be the work of God, according to . . . our "contracted notions of His attributes,"—the "natural pro-"pensities and passions" of animals are such "mysterious "phenomena"; their strangeness of "countenance"; the *principle of deformity*, "whether hideousness or mere home-"liness," and the *principle of the ludicrous*, evidence an Author (according to the Cardinal), but no "Principle or "Agent correlated to our religious ideas,"—yet certain organic phenomena, as the song of birds, the colours of sea-anemones, the utility of cattle, are conceivably lines in a hymn of praise. Again, fulfilment of prophecies, miracles confirming inspired records, the endowment of each *ego* with an element of personality surviving a Judgment Day, are not, to theists, *à priori* improbabilities. Albeit the most ardent antagonist of anthropomorphism will fail to discern a performance becoming to Deity in the vivification of germs or jelly cast adrift on the world, and the differentiation of whose progeny, being "due to secondary causes, like those "determining the birth and death of the individual," betrayed what, were we criticising "mechanical inventions," we should consider "the blunders of numerous workmen." Some teach that Omnipotence rested after six days of creative labour; Mr. Darwin's Creator retired before the Tree of Knowledge blossomed.

Mr. Darwin's theistic philosophy is beyond my power of sober characterisation. Dr. Mivart remarks that Mr. Darwin, "of course, has no difficulty in finding in [a result] "what he had previously put in" the factors; but this logical feat (and it is irrelevant to the matter in hand whether or no Mr. Darwin performed it) is eclipsed by that of finding something in the result not present in the factors. By a Calvinistic chemistry a God is manufactured from blunders and sufferings, as in ordinary chemistry a salt is manufactured from an acid and a base. But we can no more exonerate God from the responsibilities of these, and credit Him with whatever of benefit happens to arise therefrom, than we can remove the Calvinist difficulty by supposing that He who ordained the end (salvation) likewise ordained the means (prayer—therefore the elect are

not excused from praying), since another end (perdition) and another means (sins) are left unaccounted for.

From this logical abyss the religious views of Charles Darwin (according to a pamphlet of that title) drifted to a verbal agnosticism.

When will these blind partners, tottering Theism and capering Agnosticism, curvet together into the proverbial ditch?

Moral Characteristics.

My prefatory paragraphs questioned whether colossal intellectual achievements can condone for moral obliquity? And without discussing the propriety of humouring lunatics or answering children evasively, ascribing a literal meaning to "not at home," or judging those whose personal liberty having been restricted by the State lie to evade the law, we may stigmatise mendacity as a sin now-a-days, and subscribe to the dictum "Society cannot prosper by lies,"* whether or no we believe that the wise man may reassure himself, and fearlessly give full utterance to his innermost conviction; though it may be mentioned that one value of aggressive veracity is recognised by Mr. Darwin himself, when he says—"Whoever is led to believe that species are "mutable will do good service by conscientiously expressing "his conviction; for thus only can the load of prejudice by "which this subject is overwhelmed be removed" (p. 423).

The sin referred to is that insidious sort of mendacity known as hypocrisy, and that of an obtrusive, not of a passive, character. In the *Or. of Sp.* "Mr. Darwin writes "as a Christian, and," continued the *Quarterly Reviewer*, "we doubt not that he is one." Mr. Darwin wrote like a Christian, inasmuch as opposite the title-page he printed a quotation recommending men to obtain endless proficience in the literal "book of God's word and divinity," the piety of the quotation being enhanced, if possible, by the couple of quotations which precede it,—one being taken from a 'Bridgewater Treatise,' by William Whewell, Doctor of Divinity; the other from Bishop Butler's *Analogy of Revealed Religion*; also inasmuch as, when quoting the impression of Leibnitz regarding the law of the attraction of gravity "as

* *Social Statics*, by HERBERT SPENCER. London, 1851, p. 471. It will be eminently fit to point out here that the paragraph concluding the 'Reconciliation' in *First Principles* (utilised in the next clause of the article) is a copy, with a few alterations, of the concluding portion of the last section but one of *Social Statics*.

"subversive of natural, and inferentially of revealed, re-"ligion," he expressed satisfaction on noting that such impressions are transient in character (pp. 421, 422); the piety of this delivery being likewise enhanced, if possible, by the context, it being preceded by the remark that "I see "no good reason why the views given in this volume should "shock the religious feelings of anyone," and followed by a sort of endorsement from a letter written him by a "cele-"brated author and divine."

These quotations from divines and others in defence of divinity and revealed religion, in conjunction with Mr. Darwin's own remarks, indicate that Mr. Darwin, already known as a Christian,* had not renounced Christianity prior to 1859. It happens, however, that there has been published a circumstantial account†—rendered probably true by general considerations, and also more or less confirmed in sundry letters—of a conversation held in the year 1881 at Down, when Mr. Darwin stated that he had given up Christianity when 40 years of age. Visitors to Westminster Abbey may ascertain that Mr. Darwin's fortieth birthday anniversary was a decade anterior to 1859: for in that edifice is Mr. Darwin's tombstone. It has been proposed that in that edifice a medallion be placed, purchased with a margin of the Darwin Memorial Fund not absorbed by the statue or devoted to the promotion of *biological* research in honour of the writer on Coral Reefs, Volcanic Islands, South American Geology, and the Formation of Mould.

Recapitulation.

The following is a recapitulation of the salient features of Mr. Darwin's Masterpiece, as above delineated:—

From a literary standpoint it is a half-finished work, indefinite as to primary argument, incoherent in the stating of data, and tinctured with dogmatism, *petitio principii*, discourtesy, and injustice.

The several characteristics treated under the head Scientific do not admit of sufficiently succinct recapitulation.

* "1834, September 5th. . . . . In the evening we reached a comfortable "farmhouse, where there were several very pretty señoritas. They were "much horrified at my having entered one of their churches out of mere "curiosity. They asked me, 'Why do you not become a Christian—for our "religion is certain?' I assured them I was a sort of Christian."—*Naturalist's Voyage round the World* (pp. 262, 263). A sort of piety, too, pervades the entire book.

† *The Religious Views of Charles Darwin*, by EDWARD B. AVELING, D.Sc. Freethought Publishing Company. 1883.

Nevertheless their importance and their number are second to none.

It is characterised by incongruity with the standpoints of at least two species of philosophy, and shortcoming, if not useless, from a metaphysical point of view.

Its chief moral characteristic is mendacity, in that it is preceded and concluded by an active, as distinct from, and in addition to, a passive—by pious quotations and comments, in addition to reticence virtually endorsing an ascription of orthodoxy to its author—hypocrisy.

II. RELATIONS BETWEEN SPIRITUALISM AND SCIENCE: MR. A. R. WALLACE AND R. M. N.

By the AUTHOR OF "SCIENTIFIC MATERIALISM."

"Any theory, hypothesis, philosophy, sect, creed, or institution that fears investigation openly manifests its own error."

ANDREW JACKSON DAVIS'S *Motto.*

AN article under this heading appeared in the "Journal of Science" (July, 1885, p. 400), by R. M. N. From many passages I infer that R. M. N. does not, as many so-called Scientists do, ignore the authentic facts of so-called "Spiritualism": the conclusions to which they lead are serious, not to say momentous. Supposing that the Spiritualistic theory be proved, there is this gain, *viz.*, that the deviations from known natural laws witnessed by many thousands of credible persons result from the *actions* of the spirits of persons once existing in this world of life, and a logical answer to that most important question the immortality of the soul of man (to use the word "soul" in its most comprehensive form) is given, and proves it without the possibility of question. If it be denied that the recorded facts result from the actions of disembodied spirits, then it must follow that, besides the phenomenal aspects of Nature, there is behind and within them an occult power

tantamount to spiritual interposition. This would show that there is a world, beyond the world in which we live, inhabited by beings capable of suspending and counteracting those laws which we know as the laws of Nature. The facts, attested as they are by millions, cannot be ignored by any thinking mind. A mass of evidence is capable of being produced which is most overwhelming, and if adduced in any Court of Law, on questions of property or life, would make the verdict affirmative.

R. M. N. says—"Unwelcome as these facts may be to many of us, serious as are the conclusions to which they seem to lead, there is nothing to be gained, and possibly there may be much to be lost, by persisting in an attitude of blank sweeping denial." This, it must be admitted, is a fair statement, and it is much to be regretted that the prominent men of Science, who assume to lead public opinion, have not fairly met the facts presented to their consideration. The treatment experienced by Dr. Slade, at the hands of Dr. Lankester and his coadjutor, was a gross persecution: subsequent events show that the acts of spirits (as he assumed) are far exceeded in the particular exemplification which he attempted.

It must be admitted that charlatanry is present at many *séances*; but this must be attributed rather to the wonder-mongers than to the mediums, who, in their desire to gratify the wonder-seeking crowd, have endeavoured to simulate the real facts in order that they might not go away disappointed. It is patent to frequent visitors of *séances* that the power which usually attends mediums is not always present, or, if present, not always active. Mediums are but human, and it is easily to be understood that when impelled by their cupidity they are not always in that frame of quietude and passiveness which is absolutely necessary for the presentment of the manifestations. I may say that rarely convincing manifestations are obtained from a mixed class of paying attendants. This may be said, that any person really desiring proofs is seldom disappointed.

So far as my personal experience is concerned, the few presentments of which I have been a witness have led me conclusively to believe that there was an *extra mundane power active and present*. I hesitate to say that what I witnessed was the work of spirits, but to what other occult power it is to be assigned I am at a loss to determine. One well-attested fact is as conclusive as a thousand: two I witnessed placed the matter, to my mind, beyond doubt.

First.—A letter lock, of eight letters, which had been

purposely deranged, was opened by Mr. Conklin. The person who, after deranging the lock, wrote what he conceived to be the opening word, enclosed it in a sealed envelope, but which proved to be wrong in one letter. The lock was given to Mr. Conklin, the envelope delivered to persons who were appointed as judges. The solution given by Mr. Conklin was the correct word, and the lock was opened; the word written in the envelope failed to effect its purpose. The whole transaction was so arranged that it was impossible that there could be any tampering either with the envelope or lock.

Second.—I accidentally called upon Mr. Conklin: whilst with him two gentlemen enquired whether Mr. Conklin would grant them a sitting. They were introduced, and stated that they were strangers in New York and had just arrived; having heard of the spiritual movement they were (if possible) desirous of testing it. Mr. Conklin acquiescing I rose to leave (fearing that the visitors might think there possibly might be collusion between myself and the medium). Mr. Conklin wished me to stay, the sitters joining in the request; I did so. The *séance* was arranged: one, the questioner, asked if it was necessary to frame the questions in English, or might he communicate in another language? Answer: the language was a matter of indifference; the answers would be in English. The tests were knocks and writing. The questions were framed, in number I think twelve. As they were written they were placed, one at a time, face downward, before Mr. Conklin: he, being apparently in a semi-somnolent state, wrote the answers in English, seriatim, as placed before him. The answers were stated by the questioner to be exact answers, and such as he should have expected in a *vivâ voce* conversation. The questions were written in Welsh, and addressed to his wife, who had been dead twenty years, with whom he wished to communicate. He stated his conviction that he had had communication with the spirit of his deceased wife, and that the questions were upon subjects known only to himself and to her.

I must apologise to the Editor for presenting such matter for insertion in his Journal. Viewed as a philosophy, or as an analysis of facts, all objection should be waived. The narratives are couched in the baldest form, and presented to show that by no possibility could they be supposed to be mere *mind* reading—the usual subterfuge of doubters. In the first case such an assumption would be ignored, the word enclosed in the envelope being incorrect; in the latter

case Mr. Conklin was ignorant of Welsh, and it might almost be said of any other language, his diction when in his normal state being most irregular. He was almost uneducated, and had been a common sailor; but when under influence his language was free, and the words correctly spelt.

R. M. N. appears to think that the "new revelations" are mischievous in character, and by possibility will subvert every existing order of things, as he says—

> "Cast on all things surest, brightest, best,
> Doubt, insecurity, and astonishment."

This is far from my idea, for they give an assurance and reality, much wanted, which no other manifestation could satisfy; they afford evidence of other intelligences than those existing in the world's life, and present almost tangibly those of a world to come. I quite agree with R. M. N. that there is much to learn and probably much to gain, and, further, that the scientific world has proved itself most unscientific in ignoring presentments because they do not accord with the assumptions of the scientific mind. Whether Science and Spiritualism will ever harmonise there is much room to doubt. Science has its purview of phenomena with the rigid requirement of exact law; but of the inner movements of that interior something which all men possess, developed or undeveloped, of its laws they know nothing. The Christian Church has existed for nearly two thousand years, and finds the World more ignorant of and unbelieving in Spiritual matters than it was on its institution. Exactly what occurred in the early Church was experienced in the Spiritual movement. The Church contained an idealism which, rightly directed, would have advanced the human race. Spiritualism, on the other hand, without idealisation, without dogma, presents its array of facts which properly considered would lead to the same end. No, Science and Theology are both in arms. Science resists because there are no apparent laws by which the movement can be directed or controlled: Theology rejects the friend which would lead to the development of those truths of which it considers itself the patron and promoter.

If Spiritualism, or the manifestations so called, were isolated facts, and confined to one family or to one nation, a halt might be made; but when America, Europe, and Asia present the same evidences, it then becomes a common question.

Colonel Churchill, in his work on Mount Lebanon, under the head of "Magic," gives an account of some manifestations occurring there. The statement is evidently that of an eye-witness, or of one who had examined the evidences and satisfied himself as to the facts. He says (vol. i., p. 164 *et infra*) "The son of Sheik Bechir is one of the best informed of the Druse Sheiks, and has acquired a store of history and literature which makes his conversation in every way superior. He has for some years devoted his time, singular as it may appear, to the cultivation of magic, and the stories he relates of his interviews with immaterial beings are novel and startling. At times he will place a jug between the hands of two persons sitting opposite to each other, when, after the recital of certain passages taken indiscriminately from the Koran and the Psalms of David, it will move spontaneously round to the astonishment of the holders. A stick at his bidding will proceed unaided from one end of the room to the other. A new testament, suspended to a key by a piece of string, will in the same way turn violently round of itself. On two earthenware jugs being placed in opposite corners of the room, one being empty, the other filled with water, the empty jar will, on the recital of certain passages, move across the room; the jar full of water will rise of itself on the approach of its companion, and empty its contents into it, the latter returning to its place in the same manner as it came. An egg boiling in the saucepan will be seen to spring suddenly out of the water, and be carried to a considerable distance. A double-locked door will unlock itself. There cannot be a doubt that an unseen influence of some kind is called into operation, but of what nature those may conjecture who like to speculate on such matters."

"But it is in more serious cases of disease or lunacy that his supernaturally-derived powers are called into play. Previously to undertaking a cure he shuts himself up in a darkened room, and devotes his time to prayer and fasting. Fifteen and sometimes thirty days are passed in this state of abstinence and self-denial. At last one of the genii, described by him to be much of the same appearance as human beings, will suddenly appear before him and demand his bidding. He then states his position, and requires assistance in the case he is about to undertake. The genii replies at once that his request is granted, and encourages him to proceed." A lady who had been for more than two years afflicted with a swelling, which had long been mistaken for pregnancy, was cured by the passage of his hand

over her person, "and in five minutes she arose perfectly cured." A confirmed lunatic was brought before him; "in two days he returned to his home perfectly cured."

The Sheik "maintains his intercourse with spiritual agents to be real and effective." "The belief in Magic, and in the interposition of an order of unseen creatures in worldly affairs, at the bidding of those who choose to devote themselves earnestly to such intercourse is universal throughout the entire population of every religion and sect."

"Instances could be multiplied in which most extraordinary and unaccountable results have been brought about, by the intervention of individuals who make this communion the subject of their study and contemplation."

R. M. N. demands the same mode of investigation for spiritual facts as for phenomenal facts. He says Science is based *on law*, Spiritualism *on will:* supposing this to be the fact, is he in a position to state that *this will* is not restrained by law? Exactly what he claims for phenomenal manipulations the Spiritualists claim for their manifestations. He states that *under certain circumstances* Science can "foretell phenomena," and that wherever the experiment is made "the result comes out the same," and "*that under the same conditions the same results will follow.*" We have then a qualification—"There are of course numbers of cases in which the causes and conditions of phenomena have not been traced out." Now this is, as I understand it, exactly the Spiritualist's position: they have numberless facts, phenomena if you will, but know of no law or mode for the classification of them, nor has ever the attempt been made to find a law or apply a classification. It has never been presented as a Science, but merely as a succession of manifestations which appear to evade all scientific rules. Being so, it seems scarcely fair, except so far as the evidences of the facts, for Science to demand that the manifestations—which appear to subvert all scientific principles and to obey no scientific law—should be subjected to an exact formula. It should be remembered that the manifestations cannot be produced at will, as physical or chemical combinations may be, but are the result of peculiar conditions. Some of these conditions are widely spread, others but rarely occurring.

All Science has the right to demand is that the evidences of the facts are unimpeachable, and ought not to be greater—and ought not to be required to be greater—than those which would establish a case if presented

before a legal tribunal. There should be no saying, after the investigation establishing the fact, that it is impossible because contrary to the so-called laws of Science or of general experience.

Let Science fairly collect the facts (manifestations), give them fair treatment, and then, if it can, find the law by which they result. If, as surmised, the manifestations are *super mundane* in character, no secular law will fathom them. This at least may be said—that the manifestations have never subverted physical phenomena detrimentally, and have never intervened to produce social difficulties, and therefore they would appear to be amenable to some law of which those who witness the evidences are unconscious.

It is quite futile to talk of will in connection with the manifestations. A person might will for ever; unless the conditions were quite accordant and present he could not float in the air as Mr. Home and others have done.

At page 403 R. M. N. cites many manifestations, but does not show that any evil has followed: it therefore follows, whatever be the power manifested, that it is subject to restraint. It will be quite time enough, when any of the evils R. M. N. appears to anticipate occur, to ascertain "what are the limits of the powers of these 'Spirits,' and under what conditions can they be exerted?"

He says "this question has its moral aspect." Œrsted had in his mind a different class of manifestations to those termed Spiritual. The evil of Witchcraft was not its spiritual aspect, but the malevolence and ignorance of uneducated or theologically superstitious people. Assumptions were made which in no case were verified, and many were the victims to the intolerance of public opinion. There is no similarity in the facts, and can be no evidence, moral or otherwise, for or against Spiritualism.

(To be continued).

III. IGNORAMUS ET IGNORABIMUS.

WE call Science the interpretation and the comprehension of the Universe. Yet considerations to which we cannot close our eyes force us to own that the interpretation is vague and arbitrary, and the comprehension in the very last degree fragmentary. It is well to reflect how much in our systems is taken for granted without proof, and how very narrow are the limits of our knowledge. Indeed "narrow" is not the correct term. We can nowhere draw a boundary line and say that everything within such line is clearly understood, and that our knowledge of it is brought into an organic, and therefore harmonious, co-ordination. The unknown and the unknowable intersect, and even underlie, the known. In the memorable discourse from which we have taken the title of our present reflections it is shown that we can no more understand the origin and the nature of matter than that of life and feeling. Here, surely, we have too wide and bottomless chasms beneath the very foundations of our knowledge. True we may ignore these chasms, trying to persuade ourselves, with Comte, that Science does not concern itself with origins and natures. The world does not accept this self-imposed restriction. It taunts us, more or less explicitly, with our ignorance. It tells us that we do ill to dogmatise on the attributes of matter when matter itself is all the while an unguessed riddle. Nay, do we not find ourselves half unconsciously trying to explain the origin of life, of irritability, and of consciousness?

But there are other gaps and crevices in our systematised knowledge which we cannot in any manner ignore. Dismissing all enquiry as to origins and as to underlying noumena, we may adhere to phenomena, the impressions which we receive through our organs of sense. We may, as in fact it is done in all research, postulate that these impressions, if not faithful transcripts of things *per se*, bear to them a constant and definite relation. This is a strong postulate. But letting that pass, we remark the very limited number of our avenues to knowledge. In common opinion we have but five; and even if we admit a heat-sense as distinct from touch or the general apprehension of resistance, and a magnetic sense, it is still unwarrantable to suppose

that we obtain through these scanty loopholes a complete view of the universe. Had we a greater number of senses, should we not receive impressions of which we have now no more conception than a man born blind has of light and colour? Would not the information thus received greatly modify our present knowledge? To understand this point the more clearly, let us suppose a set of beings possessing the same intellect as do we, but devoid of hearing. The effects of this shortcoming on their means of social intercourse we are not going to discuss. But if incapable of hearing they would never have observed the properties of sound, and in consequence they would not have had their attention called to vibrations as the cause of sound. Under these circumstances it is not too much to say that the undulatory theories of heat and light would never have suggested themselves to the physicist. What a complete change in our Science, therefore, would the absence of this one sense—one of the senses least used in the direct interpretation of Nature—involve!

Or let us suppose a set of intellectual beings sightless, like certain insects in the caverns of Carniola and Kentucky. Being blind the discipline of optics would for them have been, of course, non-existent. The part played by light in the organic world would utterly escape their observation. Astronomy would be inconceivable, and no theory of universal gravitation could have been evolved.

Or, again, imagine scent and taste, generally regarded as the humblest of the special senses, wanting. The ideas of acidity, alkalinity, and of neutralisation would never have arisen, and in their absence the foundations of chemistry could not have been laid.

Thus we see that, if any of our present senses were wanting, entire categories of phenomena would escape us, and that entire branches of Science as we have them could never have arisen.

Such being manifestly the case, is it not justifiable to assume that, had we more senses, more gateways of knowledge, we should become cognisant of classes of phenomena which have now for us no existence, and that new unimagined sciences would be developed? A little reflection will convince most of us that the additional knowledge thus gained would in many cases inevitably modify our present views.

But it may be said—and will be said by many in full conviction—that an increase in the number of our senses is impossible. Just as rationally would it be said by a blind,

or deaf, or smell-less race of people, could such be found, that *their* number of senses was the maximum possible. But we may easily show that many additional senses are perfectly within the range of possibility. We all, in these days, hold that not merely sound, but light and heat are due to vibratory or undulatory motion. So be it: the vibrations which impress us as sound are at the rate of not more than 20,000 per second. But the slowest of the vibrations which impress us as light are after the rate of 400 millions per second. As it has been pointed out by Prof. Pierce, of Cambridge (U.S.A.) between these two limits there is room *for more than forty additional senses*, each of which might convey to the sensorium of an animal a totally distinct set of impressions. That we are not provided with organs upon which such vibrations can react is surely a very lame proof of their impossibility. Some persons suspect that certain insects may possess one such sense, if not more than one. Others raise the insoluble question whether additional organs of sense may not be evolved in man either in coming generations or in a future state of existence. But such speculations are for the present idle. We can no more form any distinct idea of a number of new senses than we can of *n* dimensions in space.

This, however, is totally wide of our immediate purpose. Unless we are prepared to deny the possible existence of such senses we must admit that our present insight into Nature is most fragmentary. We are like men gazing upon a nocturnal landscape upon which fall five narrow beams of light from the windows of a castle, leaving broad regions between them unilluminated. What these dark spaces may contain it is impossible for them to say; but they will be presumptuous in the extreme if they venture to assert that they have a complete view of the entire region, that they see all which does exist, and that whatever they fail to see is "impossible." Yet this is exactly the position which men of great reputation have not unfrequently taken. Hence true men of Science, fully alive to the responsibilities of their position, are now very reluctant to pronounce on "impossibilities."

But there is no occasion for us to indulge in conjectures concerning the possible information which might be conveyed to us by other senses if we had them. Those which we do possess fall very far short, each in its respective sphere, of giving us complete information. Let us look first at the most highly developed of all, our light-sense. Every tyro in optics knows that the retina of the human

eye does not react to *all* the solar radiations. At both extremities of the spectrum there are rays, invisible to us, the ultra-red and the ultra-violet. We can demonstrate their existence by certain artifices. It is highly probable that they—at least the ultra-violet—produce impressions on the eyes of certain insects, but so far as they are concerned we are blind. Now if those rays affected our eyes it may be regarded as certain that we should see objects not precisely as we now see them, but more or less modified. This will appear the more manifest if we reflect that fully one-third of the solar radiations do not act upon our retina at all.

This consideration not unnaturally connects itself with the question of colour-blindness, which has been so ably examined in our columns by Mr. Jabez Hogg. Is this defect—which in the sufferer very much narrows, or, at all events, renders less precise the information received through the light-sense—increasing or decreasing in frequency? In the latter case, is it not at least conceivable that a time may come when the sensibility of the retina shall be extended?

But besides the quality of the solar radiations, their quantity also fixes a limit not ordinarily passed, to our power of sight. Many animals can see where we cannot see at all, or see only with the greatest difficulty.

It will perhaps be contended that an inability to recognise very feeble lights can make little difference to our insight into the phenomena of Nature, since if objects are invisible to us in the night we may revisit them in the day, or we may make use of artificial lights. But what if, as certain facts lead us to suspect, numbers of plants and animals emit phosphorescent light, too faint for us to recognise! Here a greater acuteness of sight would open to us quite a new world.

Passing from sight to hearing, we again meet with evidence of the imperfection of our senses, and the consequent incompleteness of their teachings. There are sounds too deep to impress our auditory nerves, and others again too acute. Of the existence of the latter, at least, we are convinced by the varying range of the sound-sense in different individuals, whilst certain insects appear affected by vibrations much more rapid than any which to us produce an audible sound. Hence in pronouncing any animal species "mute" we are possibly in error. It may have the means of producing sounds which simply do not fall within our compass of hearing.

Another human shortcoming is our limited ability to determine the direction of a sound and the distance of its

origin. We may often witness among human beings a discussion as to whether a sound proceeds from a point to the right hand or to the left, in front or behind. Few of us but must, on reflection, admit that we have often been deceived in attempting to localise a sound. But in all the observations which we have made upon cats and dogs, we have never seen them thus mistaken. Let anyone scratch with his nails on the underside of a table at which he is sitting: if there is a cat in the room she will not listen in various directions, as if seeking. She will at once turn her eyes and ears to the precise spot, even if she cannot have seen the least movement of his hand or arm. Had mankind this faculty many phenomena would be more accurately traced to their sources, and certain superstitions might possibly never have arisen.

But our greatest shortcoming, both as compared with other animals and with what there is to be known in this direction, is in the sense of smell. The scent of the bloodhound is commonly held up as a type of acuteness. But far more striking is the scent of certain moths. A male emperor moth (*Saturnia carpini*) recognises the presence of a virgin female of his species at distances exceeding a mile, with woods, fences, hills, or houses intervening. This is far more striking than the faculty of the dog, which merely finds out the object of its pursuit by following its trail, whilst in case of the moth there is no trail to follow. We are apt to wonder at the delicacy of the spectroscope, but here are reactions millions of times more sensitive.

Now we have no science of odours. We detect a few of the more prominent, though even there we fail to recognise their mutual inter-relations. But had we such an odour-sense as the emperor-moth we should be able to diagnose animals, plants, minerals, and artificial compounds in general by their smell. We should by this sense be informed accurately and minutely concerning decompositions, fermentations, and putrefactions in dead matter, and concerning changes, physiological, pathological, and even in some cases psychological, in the living. Physics, and still more chemistry and biology, would be enriched and modified to an extent and in a manner which can be but very imperfectly shadowed forth.

All these considerations show us how very imperfect and fragmentary is the primary material upon which Science has to work. Entire categories of phenomena escape us. What would be the position of our bookworms if, in the ancient treatises in which they delight, letters, words, sentences,

and chapters, in great numbers, were here and there missing? What if they were not aware of the very existences of such gaps and deficiencies, but believed that they had before them the complete text, and proceeded to expound it accordingly? Misinterpretation, surely, of the wildest character would result. Yet the position of us interpreters of Nature is but too closely analogous. With our few—and, as we have just called to mind, imperfect—senses much fails to reach our understanding. Much? Possibly in some directions the most important part. Surely, therefore, we should take good heed not to talk of impossibilities. Remembering that we see only in part, we should not be hasty in rejecting any new light which is offered for our acceptance.

IV. ON THE ARCHÆOPTERYX.

DR. W. DAMES has published a monograph on the Archæopteryx in the "Palæontolog. Abhandlungen," which has been in part reproduced in the "Neues Jahrbuch für Mineralogie," and in the "Naturforscher."

Since the first discovery of this creature, "half bird and half lizard," in the year 1861, the recent find in the Pappenheim quarries, in 1877, has called up the liveliest interest. Men of Science have been concerned about the systematic position of the animal, whilst outsiders have been exercised over the enormous price paid for so insignificant-looking a specimen. Hence this fossil had become famous before its thorough description by Dames, and the facts observed have received very various interpretations.

As soon as the attempt is made to generalise an observation, and to infer broader points of view from a single case, the most conflicting conceptions are put forward, which quickly again disappear. A beginning was made in this direction by C. Vogt. As the result of his observations the skeleton of the Archæopteryx was more that of a reptile than that of a bird. As far back as 1881, however, Seeley refuted Vogt's assertion of the reptilian character of the species, and assigned to it an especial position as the type

of a peculiar family of sauroid birds. In the same year Marsh pronounced Archæopteryx as the most reptile-like bird, but considered that the earliest, most primitive, birds must be sought in the Palæozoic formations. In 1882 Dames, as he succeeded in extricating the specimen from the slab of stone, commenced his publications. He showed that a mass which Vogt had taken for bone was merely a portion of the rock. Two years later appeared his first, purely objective, description of the animal, which he regards not as a connecting-link between reptile and bird, but as a true bird, which has advanced so far in its development that it can even be assigned to a particular division of the birds, —the Carinates.

This result has been carefully worked out in the different parts of the skeleton. In the head we observe a feature peculiar to adult, recent birds, a coalescence of the frontal and parietal bones enclosing the skull. The cavity of the skull is filled with calcareous spar. The brain, as in birds now living, lay chiefly behind the orbital apertures. Not until the author had laid bare a nostril of a long, elliptical form, with pointed ends, could he succeed in bringing the several bones of the skull into harmony with those of other birds. The uncovering of the toothed beak must be regarded as a master-piece of preparation. The series of teeth is laid free to the very point of the beak, and affords a beautiful view. There are twelve teeth of almost equal size, about 1 millimetre in length, cylindrical in shape, and becoming abruptly acuminate close below the point, the edge of which is turned inwards. The teeth are not fixed as in a groove, as in Hesperornis, but each in its especial socket.

Not merely the entire head is bird-like, but the vertebral column, all the cervical and dorsal vertebræ of which have been found as far as the atlas. Those joints which carry no ribs, or only short ones, are regarded as cervical. The neck, as Vogt remarked, agrees with that of a pigeon. Dames considers that it comes to an end where the curvature of the vertebral column ceases, and where no more ribs are visible. If this is correct the Archæopteryx has twelve dorsal vertebræ, which, except the last, carry ribs. One of the most peculiar phenomena in this species are the fine, delicate, points of the ribs, which Vogt compares with a surgical needle.

Dames has also succeeded in laying bare the shoulder-bones. Vogt regarded a smooth brownish mass of stone as the coracoid and the sternum, and drew premature conclu-

sions as to their reptilian character, which are all set aside. The entire anterior extremity, upper arm, fore arm, down to the three free metacarpal bones and the three free fingers, are simply avian. Bird-like is also the foot of the Archæopteryx, consisting of four toes, the number of joints increasing by one each from the first to the fourth. All four toes terminate in claws, the first being turned backwards and the other three forwards.

For the position of this animal in the system the skeleton is of less importance than the well-preserved coating of feathers, which can be plainly recognised on the anterior extremity, the base of the neck, the tibia, and the tail. In the wings there can be counted on each side seventeen quill-feathers, six or seven of which were fixed to the hand and the remainder to the ulna. The feathers are constructed on the type of the now-existing Carinates. It is extremely probable that the entire skin of the bird was covered with feathers, as all authorities who have examined the subject are agreed with the exception of Vogt.

Archæopteryx is by no means an animal occupying an intermediate position between birds and reptiles, but a quite decided bird, belonging to a class in which *the anterior extremity is not yet exclusively used for flight*. For the separation of the two classes the author regards the appearance of feathers as the decisive point. Though the first rudiment of the feather decidedly represents the reptilian scale, it is soon developed to an organ which protects against cold, and thus is effected the separation of the cold-blooded reptiles from the warm-blooded birds, although the common origin of these two classes cannot be doubted.

The memoir calls for a few remarks. If the Archæopteryx, as Dames maintains, belongs to the Carinates, Prof. Huxley's class "Saururæ," founded for the reception of this sole species, must be abandoned.

But, taking the very facts stated by Dames, we cannot help admitting that Archæopteryx, though clad in feathers, still retains certain important reptilian characters which in the course of evolution have disappeared from existing birds. The first of these is the occurrence of true teeth, bedded in distinct sockets. The second character is put plainly forward in the words which we have italicised, "the anterior extremity is not yet exclusively used for flight." The third is a point which Dames does not mention in his interesting memoir, but which he does not deny either explicitly or by implication, *i.e.*, the lizard-like tail composed of several vertebræ.

Hence therefore Archæopteryx, whilst possessing a feathery coating, and whilst agreeing with the true birds in the structure of its skull and limbs, exhibits at the same time at least three distinct and not unimportant reptilian features just enumerated. It is surely not easy to see by what right we can refuse to such a creature the intermediate position which it has generally received.

V. SEWAGE PRECIPITATION AND THE ABC PROCESS VINDICATED.

WHEN a man has been formally convicted of crime, with all the due solemnities involved, scarcely the most absolute demonstration of his innocence will afterwards suffice for the rehabilitation of his character. Let the perjury of the witnesses, the stupidity of the jury, and the prejudice of the judge be brought ever so clearly to light, and let the unfortunate victim receive—according to farcical custom—a gracious pardon for an offence which he never committed, a part of the British public will still look at him askance and insinuate that there must have been "something in it."

Very similar is the case when a process, an invention, or what you will, has been condemned by a Commission, Royal or Parliamentary. We cannot, indeed, fairly accuse such bodies of stupidity. More commonly they are too clever by half. But being at once judges, jury, and counsel, and having the option of rejecting all evidence which does not square with their preconceived notions, they reach, or at least publish, the most amazing and the most baseless conclusions. Of course the truth ultimately comes out. But, even then, succeeding Commissions will solemnly repeat the exploded utterances of their predecessors. Of all this a most striking—perhaps the most striking—instance may be found in the Reports of the whilom Royal Rivers' Pollution Commission. On the strength of an investigation made in a very perfunctory manner, under demonstrably unfavourable circumstances, and of an experiment conducted, to say

the least, carelessly, an important process for the purification of sewage by precipitation—the so-called "A B C process"—was brought into contempt.

It was solemnly asserted by the Commissioners that "after treatment by this process the effluent sewage is very little better than that which is obtained by allowing raw sewage to settle in subsidence-tanks"; that it "removes only a very small proportion of the soluble polluting matters from sewage"; and that "the manipulations required for the extraction and drying of this manure are attended with a nauseous odour, especially in warm weather, and would occasion a serious nuisance if the works were situate in or near a town." It would, perhaps, not be easy to select three propositions dealing with matters of fact which deviate more widely from the truth. They stand out, indeed, as psychological curiosities, and we cannot but feel some little interest as to the mental—rather than chemical—processes by which men of standing and repute could bring themselves to pen such statements. They have been fully and flatly contradicted by every chemist and sanitary engineer who has taken the trouble to examine for himself. The late Mr. Keates, chemist to the Metropolitan Board of Works, who watched the process closely for three months, Dr. R. Angus Smith, Dr. Wallace of Glasgow, Dr. Letheby, Mr. J. A. Wanklyn,* besides a number of eminent medical practitioners, engineers, municipal officials, &c., most distinctly deny the propositions just quoted.

The assertion that the effluent is little better than the result obtained by allowing sewage to stand in subsidence-tanks simply excites the derision of all who have ever seen —and smelt—sewage which has been thus left to itself. It is too glaringly false to need, or even admit of, discussion.

As regards the third assertion the case is perhaps even worse. Of the numbers of people who have visited the Aylesbury Sewage Works, how many have observed the "nauseous odour" of which the Commissioners complain? Yet these visitors could probably detect a nuisance, if there were one to detect, as readily as Professor Frankland or his coadjutor.

Speaking advisedly, and keeping well within the mark, we feel free to say that it would be easy to find one hundred men, of education and position, who would be prepared formally to deny the charge of the "nauseous odour." These

* One chemist of the highest standing I omit, as he was for some time Chairman of the Native Guano Company.

men are not shareholders or officials of the Native Guano Company, and have, in short, no personal ends to serve.

Now let us suppose the question of a nuisance brought before a Court of Justice. Two individuals, having had comparatively scanty opportunities of observation, depose to the existence of a nuisance. One hundred others, many of whom have had better opportunities of observing than the two just mentioned, and opportunities extended over a much longer time, depose that there is no nuisance. We need not waste time by saying what, in such a case, the decision of the Court must be.

Now we do not pronounce the ex-Commissioners guilty of conscious and deliberate falsehood. We can readily believe that fifteen years ago, in the infancy of the process, and under the very unfavourable circumstances existing at Leamington, an odour might have now and then been detected which to the noses of strongly prejudiced persons might seem "nauseous."

But the public has good reason to complain that the ex-Commissioners and their friends, in the very face of the overwhelming opposing testimony, still continue to repeat these "conclusions." What is worse, these conclusions are rehearsed with a most Arcadian simplicity in the Second Report of the "Royal Commission on Metropolitan Sewage Discharge" (§ 161). We believe that if Prof. Frankland had, in his private capacity, made fifteen years ago a statement concerning the efficacy of any given process, and found that it was continually and completely contradicted by men of scientific standing equal to his own, he would feel in honour bound to ascertain whether the circumstances of the case were still the same as in the year 1870. Even if he did not retract or qualify his old conclusions, other persons would not repeat them with unquestioning faith. But it seems that a statement made officially, however baseless it may be subsequently found, cannot be withdrawn, and must still pass for truth in official circles.

It is interesting here to notice that the recent Royal Commission on Metropolitan Sewage Discharge did not take a step to ascertain whether Prof. Frankland's archaïc conclusions are at all applicable in our day. A journey to Aylesbury would have resolved these conclusions into nothing. But a forty miles' journey to see whether these things really are so, is, we presume, too much trouble to face in the interests of truth.

It is therefore fortunate that the publication of the Report of this Commission has indirectly served to bring out a

fresh body of evidence, which ought to do away for ever with the "conclusions" of the Rivers' Pollution Commissioners and of their echoes.

Prof. Dewar, F.R.S., and Dr. Tidy applied for permission to make a thorough investigation into the details. Their request was granted, and early in the present year they began their researches. It must be distinctly understood that they were not in any way commissioned or instructed by the Native Guano Company. They were working for their own satisfaction, that they might be able to tell the public the truth on a most important question. Hence they were under no temptation to prophesy smooth things to the Native Guano Company.

Another important point is the minute and continuous character of their scrutiny. For three consecutive months, whilst the process was carried on in the usual manner, the Works were placed completely at their disposal. Personally, or by a qualified and very skilful assistant, they were present daily, and had full liberty to examine the sewage, the effluent, the deposit, and the materials used, when, where, and how they pleased. This was a scrutiny much closer and more rigorous than that of the ex-Rivers' Pollution Commissioners at Leamington, or even than that of the late Mr. Keates at Crossness.

Prof. Dewar and Dr. Tidy express their formal opinion that "isolated observations on the composition of a sewage and of an effluent have no real value in testing the efficacy of a sewage process"—a view in which we most fully concur. They add—"Considering the fact that the strength and composition of the sewage change so rapidly and frequently, it is manifest that conclusions deduced from a few observations are *worthless, and often misleading*." Hence they made three series of experiments, each continued for twenty-four consecutive hours. Samples of the raw sewage and of the effluent were collected every half hour, and equal portions of four successive half-hourly samples were mixed together for analysis.

These three series of sampling were purposely carried out under different circumstances, as regards rainfall and character of sewage. It was the object of the inquirers to test the process under the most varying conditions, and see if it at any time failed to answer the purpose.

The first series of samples was collected from 8 a.m. January 29th to 8 a.m. January 30th. The flow of sewage was abnormally large, and it was consequently very dilute. The suspended matter was only 18·8 grs. per gallon.

In the second series, from 8.30 a.m. March 2nd to 8.30 a.m. March 3rd, the flow was still large, but the strength of the sewage was much greater, being on the average 59·97 grs. per gallon.

The third series, from 8.30 a.m. March 16th to 8.30 a.m. March 17th, was taken in very dry weather, the sewage being abnormally rank. The suspended matter was 243·6 grs. per gallon.

In all these cases the action of the process was found successful. Prof. Dewar and Dr. Tidy express their opinion that beyond all doubt "the A B C process is capable of producing a uniform effluent, notwithstanding the very varied nature and concentration of the raw material to be dealt with." They find that, irrespective of the original sewage, an effluent can easily be obtained practically clear,—that is, "*containing less than one grain of suspended matter per gallon*," though the raw sewage contained a mean amount of 104·4 grs. per gallon. Further, "The precipitation appears to be more complete as the quantity of suspended matter in the raw sewage increases.

But it may be said, What of the dissolved organic impurities, always recognised as the most important? Here we find it stated that in the three series of experiments the percentages of dissolved organic matter removed were respectively 74·80, 83·30, and 86·30! This, we submit, is a very different conclusion from the rash statement of the Rivers' Pollution Commissioners that "the process removes a *very small proportion* of the soluble polluting matter from sewage."

Nor is this all. Messrs. Dewar and Tidy find, on careful examination, that at least two-thirds of the organic matter remaining in the effluent is diffusible, and therefore cannot be "of an albuminous or complicated colloidal nature." Hence it is less liable to putrefactive changes. It is, in the opinion of Prof. Dewar and Dr. Tidy, "mainly composed of the salts of fatty acids and such like bodies."

Here, then, we have the first two of the Commissioners' conclusions very fully exposed and disposed of. If, by "allowing raw sewage to settle in subsidence-tanks," they can obtain in a few hours an effluent very nearly as good, the sooner they prove it the better for their own credit.

The third "conclusion" of Prof. Frankland and his colleagues was that "the manure obtained by this process has a very low market-value, and cannot repay the cost of manufacture."

Prof. Dewar and Dr. Tidy find, on the contrary, that the

dry manure contains nitrogen equal to 3·8 per cent of ammonia (consequently equal to 19 per cent sulphate of ammonia), and phosphoric acid equal to 5 per cent of tricalcic phosphate. These figures will be better understood if we remember that farmyard manure, in its normal condition, contains only 0·40 per cent of nitrogen, or when absolutely dry 1·95 per cent (= 2·36 ammonia or 11·80 sulphate of ammonia) and 0·18 phosphoric acid (= 0·37 per cent tricalcic phosphate). Surely a manure containing nearly twice as much ammonia as farmyard manure, and more than ten times as much phosphoric acid, is not to be despised!

Lastly comes the fourth conclusion of the Commissioners, that "the manipulations required for the extraction and drying of this manure are attended with a nauseous odour, especially in warm weather, and would occasion a serious nuisance if the Works were situate in or near a town."

On the contrary, Prof. Dewar and Dr. Tidy say—"The sewage is completely and immediately deodorised, no escape of offensive odours from the sewage into the surrounding air taking place. *The entire Works are, in our experience, free from any objectionable smell whatsoever.*"

The investigation conducted by Prof. Dewar and Dr. Tidy is both more precise than that carried on by the late T. W. Keates, F.C.S., at Crossness, in 1872, and the results more satisfactory. Mr. Keates pronounced the effluent water as "on the whole very good." He declared himself to be "of opinion that such water was in a fit state to be admitted into any ordinary river without producing a dangerous degree of pollution." But with commendable caution he pointed out the extremely dilute state of the sewage during the experiment, and remarked that it was "of course impossible to say, at least from this experiment, how far the A B C treatment would defecate sewage of a stronger character."

In this respect Prof. Dewar and Dr. Tidy have been more fortunate. They have encountered sewage much stronger and ranker than any which Mr. Keates ever witnessed at Crossness, and they have found and declared that the A B C process is competent to defecate such liquids.

The question now only remains, How often and how authoritatively the truth must be reiterated before it will be accepted, and before the misstatements of the Royal Rivers' Pollution Commission fall into the discredit due to their character?

VI. ON THE CHEMICAL ACTION OF LIGHT.

PROF. A. VOGEL, in a communication to the "Sitzungsberichte der Münchener Akademie," brings into prominence the fact that the hemlock plant which yields coniine in Bavaria contains none in Scotland. Hence he concludes that solar light plays a part in the generation of the alkaloids in plants. This view is corroborated by the circumstance that the tropical Cinchonas, if cultivated in our feebly lighted hothouses, yield scarcely any alkaloids. Prof. Vogel has proved this experimentally. He has examined the barks of Cinchona plants obtained from different conservatories, but has not found in any of them the characteristic reaction of quinine. Of course it is still possible that quinine might be discovered in other conservatory-grown Cinchonas, especially as the specimens operated upon were not fully developed. But as the reaction employed indicates very small quantities of quinine it may be safely assumed that the barks examined contained not a trace of this alkaloid, and it can scarcely be doubted that the deficiency of sunlight in our hothouses is one of the causes of the deficiency of quinine.

It will at once strike the reader as desirable that specimens of Cinchonas should be cultivated in hothouses under the influence of the electric light, in addition to that of the sun.

If sunlight can be regarded as a factor in the formation of alkaloids in the living plant, it has, on the other hand, a decidedly injurious action upon the quinine in the bark stripped from the tree. On drying such bark in full sunlight the quinine is decomposed, and there are formed dark-coloured, amorphous, resin-like masses. In the manufacture of quinine the bark is consequently dried in darkness.

This peculiar behaviour of quinine on exposure to sunlight finds its parallel in the behaviour of chlorophyll with the direct rays of the sun. It is well known that the origin of chlorophyll in the plant is entirely connected with light, so that etiolated leaves growing in the dark form no chlorophyll. But as soon as chlorophyll is removed from the sphere of vegetable life, a brief exposure to the direct rays of the sun destroys its green colour completely.

Prof. A. Vogel conjectures that the formation of tannin in the living plant is to some extent influenced by light. This supposition is supported by the fact that the proportion of tannin in beech- or larch-bark increases from below upwards, — that is, from the less illuminated to the more illuminated parts, and this in the proportions of 4 : 6 and 5 : 10.

Sunny mountain slopes of a medium height yield, according to wide experience, on an average the pine-barks richest in tannin. In woods in level districts the proportion of tannin is greatest in localities exposed to the light, whilst darkness seems to have an unfavourable effect. Here, also, we must refer to the observation that leaves exceptionally exposed to the light are relatively rich in tannin.

We may here add that in the very frequent cases where a leaf is shadowed by another in very close proximity, or where a portion of a leaf has been folded over by some insect, the portion thus shaded retains a pale green colour, while adjacent leaves, or other portions of the same leaf, assume their yellow, red, or brown autumnal tints. If, as seems highly probable, these tints are due to transformation-products of tannin, we may not unnaturally conclude that they will be absent where tannin has not been generated.

VII. ON THE PROBLEMATICAL ORGANISMS OF ANCIENT SEAS.

IT is well known that Dr. Nathorst put forward the view that many formations, hitherto taken to be fossil plants, are merely the hardened traces left by animals creeping on the mud. M. de Saporta, in a memoir published in the "Bulletin de la Société Geologique de France," replies to this hypothesis, and defends the real existence of the fossil Algæ.

It need scarcely be said that M. de Saporta by no means denies the occurrence of fossilised foot-prints and other traces of animals; but such are excluded in a great number of cases where we have really to do with fossil plants.

In the first place, it is not possible that foot-prints which first were hollow could then be moulded in relief, and impress themselves upon the lower surface of a stratum subsequently deposited over them, so that when separated they could present both surfaces of one and the same object.

Secondly, mere tracks can display no detached portions situate above or at the side of the body to which they belong.

Thirdly, it is not possible that the tracks of animals—walking, leaping, or trailing parts of their bodies after them—could display the fine delicate, sharply-marked and manifold ramifications and meshes which a series of these plants offer.

Lastly, fossils whose branching parts cross, intersect, and mutually cover each other must be true organisms, and not foot-marks, which if they meet may cross each other, but cannot be deposited over each other.

On these grounds M. de Saporta shows that the fossil Algæ called in question by Nathorst and his followers are true vegetable remains, which may be accurately described and classified. The author endeavours also to demonstrate the real existence of the "problematical" organisms which have but a remote resemblance to Algæ. He shows, by an extensive series of instances, that petrifactions in half-relief are no uncommon phenomena in which only one side of vegetable parts—generally the lower—is impressed and remains preserved. But if ancient land- or water-plants exist which are fossilised in half-relief, the main objection to the vegetable nature of the contested structures falls to the ground, and it must be admitted that the half-reliefs may be plants. That such is really the case M. de Saporta shows from the materials which he has collected. He again adduces the interlaced super-imposition of the impressions as a proof of the vegetable nature of the fossils. The foldings and intertwinings of the fossils and other spacial relations are opposed to every possibility of our having before us foot-prints.

A minute and exhaustive study of the foot-prints of animals is certainly of great interest, but M. de Saporta cautions us here against exaggerations.

ANALYSES OF BOOKS.

Modern Science and Modern Thought. By S. LAING, M.P. London: Chapman and Hall.

"THE object of this book," as the author tells us, "is to give a clear and concise view of the principal results of Modern Science and of the revolution which they have effected in Modern Thought." The author disclaims all pretensions to bring forward either new facts or new generalisations, but puts before his readers the orthodoxies of Science as laid down by Lyell, Lubbock, Huxley, and Proctor. The successive chapters of the first part of the work discuss space, time, matter, life, the antiquity of man, and man's place in nature. As a whole, the picture given of the universe and of its development is clear, and on a level with the present state of human knowledge. Mr. Laing, however, seems to retain faith in the Bathybius as "a sort of living slime." In the matter of spontaneous generation he accepts a verdict of "not proven." He writes:—"To enable us to talk of the Darwinian 'law' and not of the Darwinian 'theory' we require two demonstrations:—

"1. That living matter really can originate from inorganic matter.

"2. That new species really can be formed from previously existing species."

Now it certainly is no part of Darwin's teachings that life originated spontaneously from inorganic matter; and a demonstration that such was the case, however welcome it might be as confirming the law of Continuity, is not necessary to the establishment of the law of Evolution.

In raising the question of species, the author scarcely brings into sufficient prominence the consideration that the permanence of varieties and races within the historical epoch undermines the evidence supposed to be drawn from mummies, paintings, &c., as to the permanence of species. If the cat and the crocodile were created just as we find them, because their mummies present no essential differences from living specimens, then, by a parity of reasoning, the greyhound and the turnspit, or the semitic man, the Egyptian, and the Negro, are primordial beings, not modifications.

It seems to us that the author, in speaking of human develop-

ment, places the human infant in too sharp a contrast with the young of other animals. He forgets that the baby mias, according to Mr. Wallace, is for some months almost as helpless as the human infant.

We are unable to agree with Mr. Laing when he says: "When we come to analyse the sum of faculties of the adult man we find that they are derived to a surprisingly small extent from heredity as compared with education." If we take a negro or Fuegian child and give it a European education, it may for a few years seem equal to the young Briton, German, or Frenchman; but about the age of puberty it falls hopelessly into the rear,—nature gaining and keeping the upper-hand over nurture.

In the second part of his work the author passes on to consider the influence of modern science on religious, moral, and social questions. From the very headings of the chapters—"Modern Thought, Miracles, Christianity without Miracles, Practical Life"—it will appear that there is much which lies altogether outside of our cognizance. There is much, also, even in matters coming within our purview, from which we must record our decided dissent. We find the "Gospel of Modern Thought" presented as summarised in certain passages from Lord Tennyson's "In Memoriam," which are here said to "describe the real attitude of most of the thinking and earnest minds of the present generation." The author, in making mention of Carlyle, Renan, and George Eliot, remarks that the whole nature of the first of these writers was "antipathetic to Science." He quotes Froude to the effect that he (Carlyle) liked ill men like Humboldt, Laplace, and the author of the 'Vestiges.' He refused Darwin's transmutation of species as unproved; he fought against it, though I could see that he dreaded that it might turn out to be true." What is said concerning Renan and George Eliot need not concern us.

The Spencerian philosophy is declared to be the highest form of Agnosticism,—"a very different thing from Atheism."

"Positivism" is very fairly judged. Mr. Laing reminds us that as we widen the sphere of patriotism or philanthropy we find them evaporate in a mist of high-sounding phrases. "The 'friend of man' is very apt to be the friend of no one man in particular, and to make universal philanthropy an excuse for neglecting individual charity." Comte's religion, "Catholicism without Christianity," as it has been not unhappily called, is said to "savour too much of the Goddess of Liberty and the theophilanthropy of the French Revolution, when the disciples of Rousseau cut off heads in the name of universal benevolence."

The author's estimate of Spiritualism as "another wide-spread modern delusion" is scarcely in harmony with the facts of the case. He writes:—"In vain medium after medium is detected, and the machinery by which ghosts are manufactured exposed in police-courts; in vain the manifestations of the so-called spirits

are repeated by professional conjurers like Maskelyne and Cooke, who disclaim any assistance from the unseen world." Now here is precisely the difficulty. Maskelyne and Cooke have never, as far as we are aware, succeeded in producing under fair test conditions even the simpler forms of "psychography," They have never—though the attention of one of them was especially called to the case—fixed on the wrist of a man an iron ring, like that of Mr. Husk, too narrow to be passed over the hand. The author's remarks on dreams, somnambulism, and mesmerism, however, are worth attention.

Recurring to Carlyle, Mr. Laing makes some remarks of the highest value. He writes :—"The spread of education (he might have added 'the quality of education') has given an extension to the influence of words which threatens to become excessive. People read until they have no time to think, and find it easier to borrow the thoughts of others. And a large and ever-increasing portion of the community have learnt, in Yankee phrase, to 'orate' and use the new-found faculty incessantly and remorselessly. I refer . . . to the undue influence which oratory tends to acquire in all constitutional countries. A great orator is inevitably a great power in the state, but it does not necessarily follow that he is a great statesman."

In the next chapter, on Miracles, we find very sound remarks on their demonstration. He lays down as to the evidence required to prove a miracle—"Clearly it must be evidence of the most cogent and unimpeachable character, far more conclusive than would be sufficient to establish an ordinary occurrence. . . . It may be going too far to say with Hume that no amount of evidence can prove a miracle ; . . . but it is not going too far to say that the evidence to establish such a violation (of the laws of Nature) must be altogether overwhelming and open to no other possible construction."

Passing over the discussion on miracles and on Christianity without miracles as not within our competence, we find certain remarks on education, against which a protest is needful ; needful because they seem to be a defence of the classicalism, and consequent verbalism, against which our author has just protested. He admits that "the amount of positive knowledge, useful in after life, acquired at our English public schools, is really very little beyond the three R's. A boy who could teach himself French or German in five months, spends five years over Latin and Greek, and in nine cases out of ten forgets them as soon as he leaves school. Almost everything we know that is worth knowing we teach ourselves in after life. But the discipline of school is invaluable in teaching the lesson of self-control. . . . . The memory also is exercised, and the faculty of fixing the mind on work is developed by useless almost as well as by useful studies." But the exercise of the memory is no gain, but a loss, if it comes instead of the due cultivation of the power of observa-

tion and of the art of drawing right conclusions from what we observe. That which is agreeable to a boy is generally that for which he has special aptitudes, and if these are suppressed by dint of "canings from the master or thrashings from other boys," a Lyell, a Darwin, or a Faraday may be lost to the world.

The Young Collector. British Butterflies, Moths, and Beetles. By W. F. Kirby. London: W. Swan Sonnenschein and Co.

Mr. Kirby is a most diligent author. In the little book before us he addresses himself to a rudimentary class whose future development we can rarely foresee. The "young collector" may become by degrees an observer of the structure, the development, and the habits of insects, and may thus make valuable contributions to the science of animal life; or he may remain a collector, confining his attention to "British only," giving alarming sums for specimens reputed to have been captured in the United Kingdom (though all the while imported from abroad), and often arranging his specimens not according to their structural relations, but in fantastic patterns; or worst of all, after collecting and spoiling a number of insects, he may renounce the pursuit and take up some other hobby.

The incipient observer we respect, and wish to see him becoming more numerous. In the mere collector, except he has the good fortune to find his way to some district insufficiently explored, we feel no interest at all. The third class we regard as simply a nuisance, since they waste—and, as far as in them lies, help to extirpate—species which have not yet been sufficiently studied. We can therefore only rejoice if he ceases molesting insects, and turns his attention to "philately."

In this work Mr. Kirby first gives a general account of insects, and explains their classification into orders, of each of which some characteristic individuals are described and figured.

Next follows an account of the great order of Coleoptera, with especial reference to British species. The remaining section of the work treats of British butterflies and moths. The descriptions of the families, genera, and species are, from the size of the book, necessarily brief, and are written from a popular point of view. By an unfortunate oversight five species have been figured each twice, namely, *Zygæna trifolii*, *Triphæna orbona*, *Smerinthus ocellatus*, *Vanessa urticæ*, and *Dytiscus marginalis*.

The book is very suitable to be put into the hands of boys who may have opportunities for collecting insects.

The Microtomist's Vade-Mecum. A Handbook of the Methods of Microscopic Anatomy. By ARTHUR BOLLES LEE. London: J. and A. Churchill. 1885.

THE author has brought together into a compact volume a vast collection of formulæ of the preparations used in treating tissues for examination under the microscope; in fact it is the nearest approach to a histological pharmacopœia that has yet appeared. The need of such a compilation is great, as much periodical literature would have to be gone through to find the processes given in the present handy volume.

The methods used in modern microscopical research—such as staining, imbedding, section-cutting, &c.—are given much in detail, with a very full account of all the materials and reagents employed; and in Part II. will be found, in the sixteen chapters which it contains, modes of applying the materials and processes described to various tissues.

The only fault of the work would seem to be that the existence of a vegetable kingdom is entirely ignored. A large number of microscopists study vegetable tissues; and some accounts of reagents, &c., useful in such researches would be welcome. Let it be hoped that this much-needed matter may be added to the next edition.

A Course of Practical Instruction in Botany. By F. O. BOWER, M.A., F.L.S., and SYDNEY H. VINES, M.A., D.Sc., with a Preface by W. T. THISELTON DYER, M.A., F.R.S., F.L.S., &c. Part I., Phanerogamæ—Pteridophyta. London: Macmillan and Co. 1885.

THIS little book gives an account of the course of botanical instruction in use in the Normal School of Science at South Kensington. The first seventeen pages give an account of the methods of making preparations, preserving material for future study, and the various micro-chemical reagents used. Considering how little has up to the present time been published respecting the treatment of vegetable tissues, this portion of the work might have profitably been enlarged.

The structure and properties of the cell are well and clearly explained, and the mode of studying the same under the microscope is given in a very detailed manner.

The practical directions for the study of types are well arranged, and the plants selected for examination are in nearly all instances easily procurable,—a matter of great moment to a town student. The learner is not only told what to do with his plants, but also

what to look for when the necessary preparations have been made. Doubtless some of our makers of microscopical objects will soon bring out a series of slides in illustration, after the admirable manner of the late C. V. Smith, of Carmarthen; but students who wish really to learn had better buy or procure somehow only the plants and materials, doing everything else with their own hands.

The present volume concludes with the ferns and their allies, leaving the remaining Cryptogamia for the second part.

The book is free from the pest of a collection of examination questions. Let us hope that the second part may also omit these impediments to students.

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*On the Apparent Enlargement of the Constellations, the Sun, and the Moon near the Horizon.** By M. PAUL STROOBART. Bruxelles: F. Hayez.

THIS illusion is the more remarkable because the Moon, when at the horizon, is more distant from us by a radius of the Earth than when in the zenith, and consequently it should appear in the former case smaller by 0·5'.

The author discusses the four principal hypotheses which have been proposed to explain this appearance.

The first of these supposes that the luminary is magnified by atmospheric refraction.

The second, proposed by Alhazen in his "Optics," as far back as the beginning of the 11th century, attributes the apparent enlargement of the stars to the flattened form of the celestial vault, the base of which, according to the Arab *savant*, is more remote from us than the summit by an entire radius of the Earth. Hence we imagine the stars more distant from us when they are near the horizon than at the zenith. We know by experience that the more remote an object the smaller it appears. If, then, in imagination we place the Moon on a plane more distant from us when on the horizon than when in the zenith, we ascribe to her mentally a real magnitude more considerable in the first case than in the second.

The third hypothesis agrees essentially with the second. When the stars are rising or setting we see a great number of objects between them and us, which gives us a greater idea of their distance, and consequently they appear greater.

According to the fourth hypothesis, when the Sun and the

* Sur l'Agrandissement apparent du Constellations, du Soleil et de la Lune a l'Horizon.

Moon are near the horizon they appear less luminous than when they are elevated, which makes them seem more distant and consequently larger. Certain authors refer also to the influence of the lustre of the stars upon the diameter of the pupil of the eye, the contraction of which is said to produce a diminution in their apparent magnitude.

The author rejects the first three hypotheses, but considers that the fourth may contain a portion of truth, since the disc of the Moon and especially that of the Sun appear to have more considerable dimensions at the horizon in foggy weather than when the air is pure. He considers that the apparent enlargement of the Moon is due to two distinct causes, the first, essentially subjective, being that any object placed at the zenith appears only 0·8 of what it does at the horizon; and the second is that the Moon, when it has risen a few degrees, becomes so brilliant as to produce a contraction of the pupil which reduces its dimension to 0·7 of what it was when near the horizon. For the constellations the first cause only comes into play. For the Sun the second cause is felt only when the air is very foggy. Hence the apparent magnitude of the Sun at the horizon is more variable than that of the Moon.

Charles Darwin, and what led to and sustains his Theory. An Address by C. C. Cattell. Birmingham: Aston.

In the very outset of this pamphlet we meet with the following sentence:—"Like Sir Charles Lyell, he (Darwin) was free to investigate and teach without anxiety as to his daily bread, or the fear of man to check his speculations. Owing to the pecuniary success of his illustrious father he was a man of leisure, which the late T. H. Buckle considered as one of the essentials of progress and civilisation." Now we are entirely at one with Buckle and with Mr. Cattell, if they mean to say that the existence of a leisurely class is necessary for the highest developments of scientific investigation. Especially is this the case in biology and psychology, where the most splendid results admit of no immediate industrial or commercial applications, and are consequently unremunerative to the discoverer. One of the saddest phenomena of the present age is that the leisure of professional men, and of brain-workers in general, is more and more encroached upon. In this fact we see that modern "progress" is not unlike a swine swimming down a river—

> "The pig swam well, but every stroke
> Was cutting his own throat."

But, if we do not mistake, the "advanced thinkers" to whom Mr. Cattell belongs—at least if we may judge from the titles of his works advertised on the fly-leaf—are, as a body, anxious for the abolition of men of leisure. If, therefore, Mr. Cattell shows such views he is scarcely consistent in pointing out the existence of such men as essential to progress.

A brief, plain summary of the evidences of Evolution would be exceedingly useful; but the little work before us does not perform this important task as satisfactorily as we could wish. Even on the question whether man is descended from a lower animal form, or has been specially created as we now find him, some of the most important evidence has been omitted. We might here particularise certain Simian features in the skeleton and the arrangement of the muscles which are very frequent in the lower human races, but which are excessively rare among what is called the Aryan type. Thus the perforation of the humerus, which is normal in the gorilla and the chimpanzee, occurs in about 50 per cent of the ancient human skeletons found in Michigan. (See Mr. H. Gillman, "Certain Characteristics belonging to Ancient Man in Michigan," in the Report of the Smithsonian Institution for 1875.) Still more conclusive are the researches of Dr. Clevenger ("Journal of Science," 1884, p. 134), which show that man is not as yet perfectly adapted to an upright bipedal attitude, and that certain points in his structure—*e.g.*, the arrangement of the valves in the veins—become intelligible only if we suppose them originally belonging to a quadruped. Little less important is a paper by Dr. F. J. Shepherd, on the significance of human anomalies.

Association for the Oral Instruction of the Deaf and Dumb. Report, 1884.

This Report testifies to the satisfactory working of the Association's School in Fitzroy Square. The oral system seems to do more towards mitigating the effects of congenital deaf-mutism than any other method which has been tried. Naturally, however, we look to prevention rather than cure. If the Berlin statistics are to be believed consanguineous marriages are the great cause of deaf-mutism: at least persons so afflicted are found, in the different religious bodies in Prussia, exactly in proportion to the extent in which they countenance marriages between blood-relations. Deaf-mutism is most common among the Jews, who rather encourage the intermarriage of cousins, perhaps with a view of keeping property together; next among Protestants, who in Germany are guilty of the same laxity as we in England; whilst the affliction is very rare among Catholics, who do not sanction the intermarriage of cousins at all.

Ocean and Air Currents. By T. D. SMELLIE. Glasgow: J. Smith and Sons. Edinburgh: W. Blackwood and Sons. London: E. and F. N. Spon.

THE author commences his researches with the following simple experiment:—"If you take a flat-bottomed circular vessel, formed to revolve horizontally, partially fill it with water, and make it revolve gently, you will find the vessel at first slip from under the water, so as to give the water relatively a backward motion. A similar result will follow if you try different speeds within the limits of the water being free to take its own motion—the greater the speed the greater the backward motion. After a few revolutions the water will begin to acquire some of the forward motion of the vessel; this will decrease the backward motion; and if continued long enough to allow the water to acquire as much of the vessel's motion as it will acquire, it will take almost, but not quite, the same motion, for the water towards the surface will still lag behind the vessel."

This illustrates on a small scale what actually takes place on our globe. The earth turns eastward, and the water of the seas, lagging behind, forms what appears as a current westwards. This current is of course most marked where the rotation of the earth is most rapid, that is, in the equatorial regions. If these regions were open sea all round the globe, we should have simply one uniform westward current; but as the way is barred by the continents of America and Africa, and is much broken by the Eastern Islands which lie in the track of the current, no such continuous stream is possible. In the Atlantic, when this great current approaches the coast of America, it is deflected in two branches; the smaller goes southwards, whilst the larger, owing to the trend of the coast, turns northwards and forms, among other currents, the Gulf Stream. A part of this goes up into the Polar Sea, and another part southwards towards the coast of Africa to feed the central westward current. In the Pacific and Indian Oceans we have corresponding phenomena.

The same "lagging behind" must produce the chief aërial currents—the trade-winds.

The author's theory is not merely the simplest and most intelligible explanation of oceanic and atmospheric currents, but seems best to account for the phenomena as observed. We strongly recommend this pamphlet to all who are interested in meteorology and physiography.

Where to Find Ferns: with a Special Chapter on the Ferns round London. By F. G. Heath. London: Society for Promoting Christian Knowledge.

This little volume is intended as a companion to the author's beautiful "Fern Portfolio" which we had the pleasure of noticing some time ago. Its object is to give in the briefest possible compass indications of the habitats and the distribution of our British ferns. The author recommends "fern hunting" as a delightful pastime which gives zest to any country walk. He complains, with perfect reason, that life in the present age is far too sedentary. He might here have noticed the educational value of any pursuit which compels men and women to be observers, to gain as much as possible of their knowledge direct from Nature, and not through the medium of words.

Under the head "Definitions of Terms" we find an illustrated explanation of the technical language of botany, as far as it is needful for the lovers of ferns.

Then follows a pleasant chapter on "Fern Habitats," which calls up to our mind delightful memories of rambles taken long, long ago. The author seems scarcely to believe in the extirpation of lovely species in many of their former haunts. We must remind him, however, that the collectors sent out by London dealers are enterprising and persistent, and do not by any means confine themselves to known localities. Not a few, moreover, of private collectors, whether for the herbarium or the fernery, are shamefully greedy, and if desirous to secure plenty of specimens for themselves, seem scarcely less eager that none shall be left for others.

The chapter on the cultivation of ferns is short, but—indeed like the whole of the book—shows the author's thorough practical acquaintance with his subject.

Under the head "Ferns round London" we find an alphabetical list of the localities where certain species may be found in the home-counties. We are glad that the haunts of each species are not laid down too minutely. Thus no encouragement is given to the lazy plunderer who would like to walk to the exact spot and strip it of its rarities.

Lovers of ferns, and naturalists generally, will, we are sure, feel grateful both to the author of this little book and to the Society by which i is published.

CORRESPONDENCE.

*** The Editor does not hold himself responsible for statements of facts or opinions expressed in Correspondence, or in Articles bearing the signature of their respective authors.

MATTER AND MIND AN AUTOPSY.

"Und Gott ist heut', 'wer gestern Mensch nur war." *
SCHILLER'S *Don Carlos*.

IN the July number of this Journal, the sequel to several former ones with the same earth-shaking motive, is a letter of mine, "Immanence not Transcendance," † &c., in which, as the synthesis of exact Physical and Medical *data*, I labour to give the death-blow to all falsely-called "Spiritualism," with which it is clear all the Religions of the World stand or fall. I then and there, as in other contributions to Hylo-Ideal Monism, aim at proving that our bodily *sensorium* is virtual creator of all things visible and cogitable. So that when we seem to look "out" into an "external" universe we really look "inward" on the subjective purview of a phenomenal world—Cosmos or chaos as it may be—represented by inner states of our own personal consciousness. No sentient eye, I contend, can ever possibly have beheld an object not the content of solipsismal vision. And no mind can ever think a thought not an act of its own cerebral organism. So that the venerable Cartesian, or other cosmical sophism, "The Universe is a thought of God," must, in our *Neo-hermeneusis*, stand "The Universe is a thought of Man, ultimately of the Self." This change of front is clearly tantamount to the negation of the *Paranomasia*, or cart before the horse provisional assumption, of a separate immaterial Motor, or Vital, Principle to energise brute matter or living body —a theory quite irrational and unthinkable—as the interaction of an incompatible Entity and Pseudo- or Non-Entity, a theory, for near two hundred years past, superseded by the scientific one of Energy as the *function* merely of self-active and dædal Matter or Body *per se*. Immaterial Dualism, or Animism, is indeed identical with Ghostism, "Sacred or Profane," which Physics and Physiology have long since disposed of. Medicine —however the Society for Psychical Research, and eloquent rhetorical anachronists like Mr. A. Lang, in his exhaustive article on *Apparitions* in the "Encyclopedia Britannica," may

* God really means only Lord (*Khoda*), the Latin *Vir* (as distinguished from *Homo*), the German *Herr* or *Mann* (as distinguished from *Mensch*).

† By misadvertence this letter did not appear last month.

cavil at the assertion—has quite succeeded in diagnosing as *morbid* cerebral symptoms, and therefore as bodily *infirmity*, not as assumed—an heir-loom of Agriology—in Jewish, Christian, and other Religions, as a spiritual influx or afflatus from a supernal source,—all such alleged Transcendentalism. Even "Nature," divinised by the later Platonists and other Mystics and Pantheists, as now by the vulgar realism of Scientism, is but a mental image of the Ego, a bodiless creation of a *healthy* Brain, as the phantoms of Hamlet, Macbeth, Richard III. are of an *unhealthy* one. No *crux* lurks in these propositions other than the *inertia*, the *damnosa hereditas* of prejudice, superstition, and traditional custom, or second Nature, which, shrinking from the complete *volte face* necessitated by mental innovations, makes such ever a painful crisis in the history of society. Supreme Order, under these conditions, is envisaged as supreme Disorder. Contrary to popular opinion, Mental and Physical Science are quite at one on this *rationale*,—formally since Hume, but informally throughout the whole past ages of Philosophy. Both Bacon and Locke adumbrate the thesis, the latter distinctly stating that the *adit* from human to Divine is an impossible *transit*. Newton, however, *felix cognoscere causas*, was the fortunate formalist who—by his hylo-ideal discovery of Attraction—first placed the Automatism of Matter, and its corollary the nullity of "Spirit" as an inexpugnable verity, on a level with the *Agora*—a heritage of the meanest mind. The *average* general intellect ought, since 1687, to see that since Matter does its own work no other substance is necessary, and that anemistic Dualism, even if thinkable,—*which it is not*,—falls quite to the ground. And yet, *O cæca mens mortalium*, Newton himself—like Priestley later—quite ignored the gist of his own induction. Both of these (to say nothing of later chemical, physical, and physiological discoveries, and notably Wöhler's *pace* Mr. Romanes' hazy ambiguity, in his recent "Rede Lecture," and other Opportunists) establish the truth of Materialism, never doubtful in sound Medical Science, and doom "Spiritualism," the very name of which is a misnomer, to the limbo of other exploded pseudo-sciences, like Astrology, which for many generations held potent sway, not only in the schools, but also in the world of events. A strong trace of it is discoverable even in Napoleon. To Wallenstein, and other 17th century heroes, astral superstition was what religion was to Cromwell, and to belated Chinese and Khartoum General Gordon. Kepler lent it the ægis of his great name. And a prediction of Tycho Brahe, founded on the Emperor Rudolph's horoscope, naively confided in by that generous patron of nascent Astronomy, is reported by Sir D. Brewster to have actually been the cause of his death.

ROBERT LEWINS, M.D.

THE DRAGON PLANT (*ARUM DRACUNCULUS*).

In an old-fashioned garden, which for more than thirty years has afforded me a miscellaneous store of vegetable treasures, still exist some living descendants of plants belonging to a previous horticultural dynasty, when the garden was in the possession of a Lancashire herbalist. Amongst them is the "Dragon Plant," an *Arum* from the South of Europe, originally imported into this country A.D. 1549. With its reputed medicinal and other virtues I had not cared to acquaint myself; but this season I resolved to observe, more carefully than before, its curious property of emitting a fetid odour during the time of its flowering.

Two grand flowers on the same stock came to maturity together. These were visited several times each day as they expanded. For three or four days from the time when the spadix, and the deep purple lining of the spathe, first appeared, the plant emitted no odour whatever. The spadix was vigorous, and the lining of the spathe in full glory, but no effluvium was perceptible, nor did I observe a fly near the plant. On the following morning the fetid smell was quite sufficiently observable at some distance, and a company of flies were buzzing round and settling upon the plant: amongst them were *Musca vomitoria*, *M. Cæsar*, and *M. pluvialis*. During part of the next day the circumstances were the same; but on the third day the odour had entirely ceased, and not a fly was observable near the plant.

This surprised me, for in previous years I had noticed a longer duration of the disgusting smell. There was no return of the odoriferous emission, and as soon as the spathes were a little withered they were cut off and examined. At the very bottom of the interior of the spathe, in one case, there were three large dead flies; in the other, six. They had crept down over the burst anthers, carrying the pollen to the stigmas below, in search of the nidus to which they had been attracted by the odour of carrion.

One or two points are curious:—The *precise* resemblance between the odour of the plant and that of carrion. We are supposed to know the sources of the smell arising from decomposing flesh; but in the *Arum* there was no decomposition going on, but full vigour of life. If noses were as reliable as ears, I could affirm that the two odours were in perfect unison. Had odours of all kinds been tried in the philogeny of Aroidæ until the development of this particularly beastly scent, fortuitously attained, bestowed the boon of survivorship upon the Dragon Plant? But what a roundabout way, and all to secure self-fertilisation. It is, however, hard to believe that so exact a copy of an odour could have been attained fortuitously or by small

increments; and to assert that it *must* have been so is to discourage search after other, not less orderly, ways and means in Nature.

Why should the odour begin and end as it did? The period of its emission was shorter than had been observed in some previous years, when the plants may have flowered in showery weather, and the process of fertilisation may have required a longer time for its completion. In 1885 the season of flowering was distinguished by uninterrupted sunshine, and the flies were plentiful. When the ovaries were fertilised the visits of flies were no longer needed, and the plant ceased to emit the peculiar scent so alluring to them.

Other plants in my garden emitting a carrion-like odour are *Veratrum nigrum*, a brown-purple *Lobelia*, *Pothos fœtida*, &c. The two former attract flies. *Pothos* is an American plant, and flowers too early for the help of the flies. All are of a purplish chocolate or livid colour, nor do I know of any really bright-coloured flower having the taint of carrion. To obtain the exact flavour of the Jargonelle pear from coal-tar the process is one of elimination, getting rid of the pungent elements that would utterly disguise the more delicate forms of sapidity. Is it possible that plant odours may be highly compound—the perfume of the Jasmine, for example, being capable of being analysed into component elements far less grateful when taken separately? The elimination of a corrective constituent in the original odour of the Dragon Plant is more imaginable than the spontaneous production of such a very un-plant-like smell. I saw no special scent-glands, but suspect they were present on the surface of the spadix, which was very like that of a piece of beef after having been exposed for some time to the rays of the sun.

HENRY H. HIGGINS.

SEWAGE TREATMENT AT CROSSNESS.

"But what went ye out for to see?"

You will doubtless be aware that the Metropolitan Board of Works recently invited the London Section of the Society of Chemical Industry down to Crossness to see the wonderful operation of making manganate of soda, with which the sewage of the Metropolis is some day to be disinfected. Had the Board heard all the remarks of their experienced, practical visitors, on the arrangement of the plant, &c., they would not have felt highly flattered.

It appeared that the invitation did not extend to the experimental sewage-works. A few adventurous spirits, who did manage to get a peep into these jealously guarded regions, saw enough to convince them that if the Board reject the "A B C process" they are still stumbling over the very A B C of sewage treatment, and trying to keep up, at any rate, the appearance of doing something. There are an alum-tank, a lime-tank, and a manganate-tank. The manganate, it appears, is converted into permanganate by a stream of sulphuric acid, which joins it on its way to the sewage. The quantity of acid which will thus have to be used in pure waste (for the resulting sodium sulphate has no value in purifying sewage, and is, if anything, detrimental) will be far from inconsiderable. Possibly, however, the Board will endeavour to economise by setting up a factory for making their own caustic soda and their own sulphuric acid, and may ultimately come at some startling results. It is not every chemical manufacturer who has the pockets of the ratepayers of London to fall back upon.

SODIUM HYDROXIDE.

BESTIARIANISM IN LITERATURE.

IT is remarkable how all classes of literature have become tainted with what is called by its advocates "Anti-Vivisectionism." It is insinuated, more or less broadly, in novels of very questionable morality. It figures in the semi-philosophical writings of the "Shrieking Sisterhood." And it is even taught by prelates in expositions of Scripture. Witness the following passage by the Bishop of Derry:—"Indignation is justly expressed at these scenes of vivisection, where experimenters, with superior smile, grope their way down the dim track of animal pain. But here a man suffered, and no end, even of curiosity, was to be obtained."

These few words show plainly either inability or unwillingness to understand the position of the physiological investigator. The notion of his "smiling" through the microscope could only occur to a rhetorician. In sober truth the experimentalist—whether he be working on animals, plants, or inorganic matter—does not wear a "superior smile." His whole mind is devoted to the task of observing faithfully and interpreting correctly the phenomena which present themselves. As to the "dim track of animal pain," in most cases it does not exist at all, since the subject is rendered incapable of feeling by an anæsthetic. Even where pain does occur it nowise serves us a track leading to any

results, and we had much rather dispense with it. To take pleasure in animal pain and death we leave to the sportsman.

It is interesting to note the words "no end, even of curiosity." The love of truth was formerly regarded as one of the highest motives by which a man could be actuated. Now it is contemptuously termed "curiosity."

GRADUATE.

SEX.

IN most countries the sexes are balanced by killing she-children, and as there are prejudices against this in England we ought to do our best in other ways. Yet the cause of sex is the most obscure and neglected domain of ignorance and chance!

Captain Burton says that in Para, Brazil, there are five she-children to one he; but he gives no reason. There seems to be a tendency for sex to follow the senior parent. It has been suggested that male sex depends on nutrition; but the rich have no more boys than the poor, and Earl Spencer's observations on cattle, though valuable, are very imperfect. Is not the best field for observation to be found in eggs? Is the sex decided ere the egg is laid? I believe it is, and that poultry fanciers choose short eggs to produce hens. If not, it would be interesting to know whether sex is affected (or effected) by greater warmth about the centre of the nest and by less warmth at the outer part. Could incubators be made to produce cocks or hens, according to warmth? If not, perhaps the inquiry might be limited to the time before laying, and perhaps it might be pushed back to the spermatozoa. Some observant poultry fancier might give us light.

HUGH BROWNE.

July 13, 1885.

THE SHORTCOMINGS OF THE METRIC SYSTEM.

IT is often left out of sight that the metric system, as at present used in many countries and advocated by lovers of Internationalism, contains and involves very much more and other than the principle of decimal divisions.

It is this "more and other" which makes the people of England hesitate at its adoption. It has been pointed out some years ago, in your Journal, that whilst in our English system the names of

the different denominations—grain, ounce, pound, stone; line, inch, foot, yard, mile, &c.—are for the most part words of one syllable, easily remembered, and not easily mistaken, in the metric system this is quite different. One only denomination—the gramme—has a monosyllabic name. The rest are for the most part words of three or four syllables, and not a few of them—such as decigramme and dekagramme, decilitre and dekalitre—are apt to be confounded with each other in speaking and writing, especially when abridgments come in.

But there is another element of simplicity in our English system. We express quantities, either of weight or measure, in terms of whole numbers. If we say that any article is 3 inches long, or that it weighs 5 ounces, no idea save that of the inch or the ounce enters the mind. We know, of course, that the inch is the twelfth part of a foot, and that the ounce is the sixteenth part of a pound; but we are not constantly obliged to keep these relations in mind. We should feel it very cumbersome if—instead of saying that something was 3 inches in length or 5 ounces in weight—we had to say that it was three "twelfths of a foot" long, or that it weighed five "sixteenths of a pound." Yet if we accept the metric system in its present form we shall have this or a similar inconvenience whenever we speak of weights or measures.

T. P.

THE "INVENTORIES."

Ex officio you are—or ought to be—omniscient. I ask you, therefore, how it is that the ruling powers of the "Inventions' Exhibition" show themselves so much less liberal than their predecessors of the "Healtheries" last year?

In 1884 the holders of season-tickets were admitted whenever the Exhibition was open to the public at all. Exhibitors or their representatives could go in and out of the Exhibition premises as often as they found it necessary. Last, but not least, complimentary season-tickets were sent to all scientific and technical journals. This season all this is altered. Who is, or expects to be, benefitted by this narrow policy?

FLANEUR.

THE NEW NATURAL-HISTORY MUSEUM.

In consequence of the strictures of your able correspondent, the Rev. H. H. Higgins, I paid a visit to this out-of-the-way palace, and I found his objections more than verified. The skeletons of whales, &c., are placed in a cellar, where the massive square pillars of brick and stone render it quite impossible to get an unbroken view of the large specimens from any one point.

The great ornithological gallery is principally lighted by a range of *south* windows, which in sunny weather are necessarily kept covered with blinds. Hence many parts are very insufficiently lighted,—*e.g.*, the cases occupied by peacocks and their kindred. Many of the smaller birds, such as the humming-birds (not including the splendid Gould collection), are placed on shelves so lofty that neither the specimens themselves nor the labels are distinctly visible. This is a case of want of room (!), of which there are proofs on every hand.

I should submit that in constructing any kind of building—especially one for a public purpose—the architect should be held to consider first and foremost the purpose in view. This, in case of a museum, involves ample room for extension and good light. In examining any and everything, from the most delicate microscopic objects down to matching off the shades of cloth, a *north* light is insisted on by trained observers. South windows, therefore, should have been rigorously avoided save for passages, stairs, &c.

In the mammalian gallery, in a few cases, the stuffed specimens are accompanied by the skeletons of the species. But the great osteological collection occupies a separate gallery in the top storey. Surely in our National Museum, if not each species, yet each genus, should be accompanied not merely by the skeleton of one of its members, but by typical, anatomical, and embryological preparations. For all this, of course, there is in the vaunted new building—"no room." But how many thousands might have been saved, or how much more room obtained for the same money, had the powers that be taken a practical, common-sense view of the matter. The mistake, for the present, is irretrievable. Parliament will not, during the present generation, vote the money for a fresh building in a more suitable locality.

F. Fernseed.

NOTES.

In 1875 Boussingault found the temperature of hailstones $-10{\cdot}3°$, when the temperature of the air was $+26$. A few days later M. Cailletet determined the temperature of a large hailstone as $-9°$.

According to MM. Bornis and Daniel, who have conducted observations on the Senegal for five years, there is no relation between the indications of ozonoscopic paper and the intensity of yellow and bilious fever.

We learn that in Russia the works of Darwin, Spencer, Agassiz, Huxley, Lewes, Moleschott, Büchner, Vogt, and Reclus are forbidden to be issued from circulating libraries. Before taking up our parable on this subject let us remember that a few years ago a set of the works of Darwin, Spencer, and Huxley was seized by the Canadian Custom-house as "immoral."

A rose tree growing in the New Gardens, Whitby, is said to have had this year flowers and buds to the number of 3000.

S. Eadon, M.D., M.A., Ph.D., writing in "Light" on the od force, says "Od cannot be magnetism, for that force is only inherent in a few substances, and can only be conveyed along certain kinds of bodies." He ought to know that Faraday proved the magnetic condition of all matter, and that magnetism, unlike electricity, cannot be insulated.

The "Lancet" very justly remarks that faith-healing is simply the converse of the "old trick of making a man ill by persistently telling him he is ill until he believes it."

A gigantic Mosasaurien, from the phosphatic chalk of Mesvin-Ciply, near Mons, has been secured for the Belgian Royal Museum. The length of the skull and of that part of the vertebral column preserved is from 9 to 10 metres. The lower jaw measures 1½ metres.

Messrs. Smith and Dorsey have furnished, at the last meeting of the American Society of Civil Engineers, important results on underground temperatures. At New Almaden, in California, at the depth of 180 metres the temperature is 122° F., but at 450 metres the temperature is quite supportable. In the Eureka mine the temperature at 360 metres is no higher than at 30 metres from the surface.

According to "Science pour Tous" hay-fever and *coriza a rosarum odore* can be traced as far back as the 16th century.

Judge Field, of the Supreme Court of the United States, relates in his Memoirs, just published, that in 1862 there occurred a mysterious epidemic the origin and nature of which have never been explained. A mere touch with the end of the finger was sufficient to convey the infection.

The present Exhibition of Inventions is not, it appears, the only one which has proved attractive to rats. These rodents, like bureaucrats, love exhibitions in general.

According to the Hydrographic Office at Washington the highest waves in the North Atlantic reach 15 metres.

In the Botanical Gardens of Dijon is a poplar 40 metres in height, and 14 metres in circumference on a level with the ground. Its age is estimated at 500 years.

A correspondent at Port Elizabeth informs us that the present winter is more severe than any in South Africa within the memory of man. Some persons in the neighbourhood of Port Elizabeth have actually perished from cold.

Dr. Bonaria, of the Lucknow Botanical Gardens, reports the planting of *Eucalyptus globulus* for sanitary purposes as a failure, and wonders that the tree should ever have been thought suited for this purpose.

According to the "Medium and Daybreak" a mesmerist, by means of "passes," turned a yellow tulip white. Such an operator would be invaluable at bleach-works.

In some parts of Africa the Negroes are of opinion that any man who has survived a stroke of lightning is rendered incapable of swimming.

Prof. Enrico di Mombello, in a recent lecture, described Giordano Bruno as one of the pioneers of Evolution, which he characterised as the old Aryan theory of the universe, in opposition to the Semitic conception of mechanical creation from without.

We learn that at the last meeting of the "Hermetic Society" an adjournment until the winter was agreed upon, in order that the leaders of the Society might devote their time to a crusade against physiological experimentation, or "vivisection" as they are pleased to call it. It is well to know our enemies.

M. Charles Richet finds experimentally that normal children, weighing from 6000 to 9000 grms., produce hourly about 4500 calories per kilo. of their weight.

The evening after-glow so conspicuous in the winter of 1883 has again become very intense, and has been observed in various

points of Italy, at Paris, and at Honfleur. Its reappearance is considered not in harmony with the Krakatoa hypothesis.

A statue of Nicolas Leblanc is being erected in the Conservatoire des Arts et Métiers, at Paris—eighty years after the great inventor perished of want. The stone given in place of bread is sometimes rather late.

On a recent occasion much wonder was expressed what could have induced the Metropolitan Board of Works to invite the Society of Chemistry down to Crossness, there to see a "fearful squandering of public money." The few visitors who contrived to see the experimental works describe the odour as most unpleasant.

The "American Naturalist" says—"People who are opposed to what is popularly known as 'Vivisection' may be divided into two classes, the reasonable and the unreasonable." With all due respect to the writer, we, at least, never met with a "reasonable" Bestiarian.

The same journal raises the interesting question, Upon what did the early scorpions—*e.g.*, of Gothland—prey?

Anent the dog-nuisance, we are informed that in the suburban village of Crouch End twelve persons went in one day to a chemist there to have bites cauterised.

Dr. Auer v. Welsbach has succeeded in decomposing didymium—not unfortunately into two known elements, but into two new bodies, praseodym and neodym. Thus the number of elements is increased.

From all sides we hear accounts of the swarms of green flies—winged Aphides. Their coincidence with the unusual predominance and prolongation of the polar current (which is still blowing in this last week of July) is attracting notice.

Mr. R. H. Govett ("Transactions of New Zealand Institute") describes the bird-catching tree, *Pisonia Brunoniana*. The seed-vessels secrete a very sticky gum, in which not merely insects, but birds are entangled and perish. Whether the tree utilises the animal matter thus conveyed to it is not stated.

The Observatory of Harvard College has recently become entitled to a bequest of nearly 300,000 dollars, under the will of the late Robert Treat Paine, of Brooklyn.

M. Leloir ("Comptes Rendus") has studied leprosy in Norway. The disease is confined to the coasts and the neighbourhood of the fjords, and it is altogether becoming much less prevalent: if contagious, it is in a very slight degree.

M. Kourbassoff finds that the bacilli of splenic fever are always transmitted from the mother to the fœtus, and that if a

female which has been vaccinated is inoculated during pregnancy with a virulent cultivation the fœtus is not protected.

If Canon Liddon accepts the vacant see of Salisbury, Bestiarianism will gain another advocate in the House of Lords.

A new insect pest, worse than the *Phylloxera*, is said to have attacked the vineyards of Roumania.

Omaloplia variabilis is attacking the hops in certain parts of Bohemia.

It is lamentable to find that about a quarter of a million humming-birds are yearly imported into this country for the gratification of a puerile vanity. In 1872 three thousand skins of birds of Paradise were exported from the Aru Islands. When will this wretched trade be stopped?

Mr. Griffitt, on his silk farm near Smyrna, has obtained 174 lbs. of cocoons from a single ounce of silkworms' eggs.

The recent investigations of M. Aug. Charpentier show the mean position of the maximum of visual intensity is in the yellow of the spectrum, not far from the ray D. The maximum of luminosity is near the ray *b*, on the confines of the green and blue. The luminous perception and the perception of forms correspond to two distinct physiological processes.

According to M. S. Wroblewski ("Comptes Rendus") the electric resistance of bodies decreases much more rapidly than their absolute temperature, and reaches zero at a temperature not far from that obtained by evaporating liquid nitrogen *in vacuo*.

The earthquake at Dorignies-Flers-Douai, in the Department Nord, affected merely the superficial chalk-formations, whilst miners at work in the coal-mines beneath neither heard nor felt anything abnormal.

The "Medical Press and Reporter" mentions the death, at Poole, of a man named Blanchard, from the sting of a bee in the neck.

The "British and Colonial Druggist" writes—"Dr. Frankland resigns the Professorship of Chemistry at the Government School of Science and Mines after the present Session. Candidates for the post may address the Secretary if they please, but there is a rumour about the warming-pan having already been put in the vacant place for the benefit of a certain rather juvenile and very dogmatic Ph.D.

The Rev. J. H. Sutton Moxley, Chaplain to the garrison in Barbadoes, and Prof. J. B. Harrison, F.C.S., after a long series of experiments, find themselves unable to confirm the views of Dr. Freire, of Rio Janeiro, that the graves of persons who have

died of yellow fever are foci of infection. Their interesting experiments could not have been undertaken in England.

The Hon. William Macleay, of Sydney (a descendant of the author of "Annulosa Javanica"?), has founded and permanently endowed four Fellowships of £400 each, to be attached to the Faculty of Natural Science in the University of Sydney. The candidates must have taken the degree of B.A. in the University in question, must be actively engaged in research, must hold no other considerable appointment, and are to be liable to annual reappointment, this being considered necessary to prevent abuse of the endowment.

[We should certainly fear that if these Fellowships were tenable for life they might become mere pensions; but we think that one year is too short a period, since many trains of research (especially biological) may occupy two years or more. Hence we fear that the holders of these Fellowships will be disinclined to undertake any very extensive investigation, which, if not re-elected at the end of the year, they might be unable to complete. We think two years the least time within which a man's capacity and industry can be fairly tested.]

We understand that Mr. Alexander Watt has been for many months engaged in writing a comprehensive practical treatise on the Electro-deposition of Metals, including the Electrolytic refining of copper and other metals, and treatment of ores. The work, being now complete, will shortly be in the hands of the public. The publishers will be Messrs. Crosby Lockwood and Co.

M. Straus finds, from statistics collected in the abattoirs of Munich and Augsburg, that the proportion of tuberculous calves does not reach 1 in 100,000. So that the danger of tuberculosis in obtaining vaccine from these animals is practically null.

The Hainosaurus, a fossil marine Saurian recently found near Mons, is supposed when living to have been about 50 feet in length.

According to the "Adelaide Observer" the line between Gordon and Ballarat was on one occasion so densely covered with caterpillars (species unknown) that a train had to go back for nearly a mile to get sufficient impetus to ascend an incline.

Prof. Huxley's retiring pension is to be £1200 yearly. Who are to be his successors it is not yet known.

XUM

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